Astounding

SCIENCE FICTION

Reg. U. S. Pat. Off.

OVEMBER 1948

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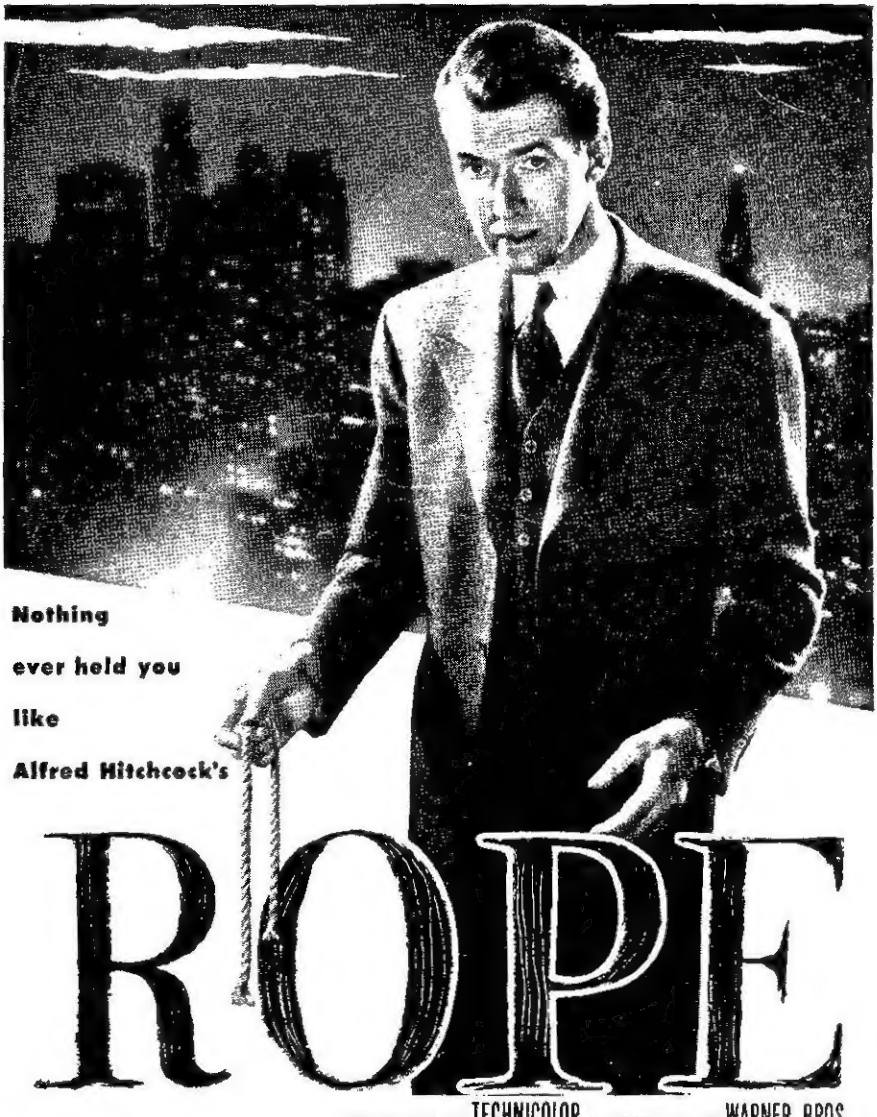
ROUGH YOUR
MUNITY CHEST

HE PLAYERS OF Ā

BY A. E. VAN VOGT



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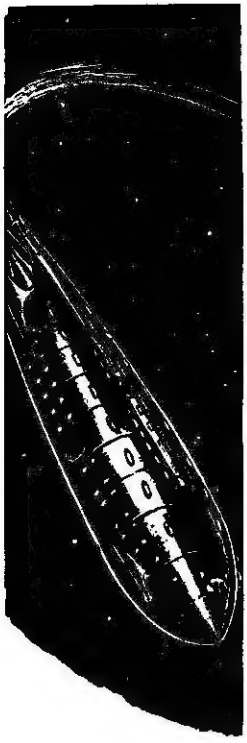

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Illustrations by Cartier, Orban and Rogers

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JOHN W. CAMPBELL, JR.

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NO COPYING ALLOWED

The proposition involving the science-fiction hero who captures the enemy device, brings it home, copies it and puts it into production is being abandoned in modern stories. But the actual difficulty of such a problem is always interesting and worthy of consideration. Only recently has Earth's own technology reached the point where such copying is not possible; today it is definitely impossible in a large field of devices.

Let's first consider this situation: Time: About 1920. Place: An American Army Air Base. Action: High overhead a small airplane tears across the sky with a high, thin whistle. Ground observers, after tracking it for a minute or so—during which time it has passed out of sight—report incredulously that it was doing between nine hundred fifty and one thousand miles per hour. It circles back, slows abruptly as the whistle dies out, and makes a hot, deadstick landing. Investigators reach the cornfield where it landed, and find it ninety percent intact—and one hundred percent impossible. Swept-back wings, no tail, automatic control equipment of incredibly advanced design, are all understandable in so far as function intended goes. But the metal alloys used make no sense to the metallurgists when they go to work on them. The "engine," moreover, is simply, starkly insane. The only indication of anything that might remotely be considered an engine is a single, open tube—really open; open at both ends. But the empty fuel tank had tubes leading into some sort of small jets in that pipe. The athodyd being unheard of in 1920, the thing is senseless. Filling the fuel tanks simply causes a hot fire that must be extinguished quickly to prevent burning out the tube. The fact that this is a guided missile intended for launching from a four-hundred-mile-an-hour bomber makes the situation a little difficult for the 1920 technologists; the athodyd won't start functioning below two hundred fifty m.p.h., and nothing on Earth could reach that speed in 1920.

Meanwhile, the Signal Corps experts are going equally chittery trying to figure out the controls. First off, the plane's markings were clearly an advanced United States

Army design. Many equipment parts bore United States Army Signal Corps markings and serial numbers. But the equipment inside is not only of advanced design, it's of meaningless design. The idea of printed circuits is fascinating, but understandable if not reproducible. Pentode amplifiers the size of a peanut are fascinating, not reproducible, and only vaguely understandable. For one thing, the filament isn't used at all; an indirectly heated cathode is a new item to them. However, the items that really stop them are several varieties of gadgets, all about the same size, but of violently different characteristics. There are units one eighth inch in diameter by about three fourths long which have resistance varying from one hundred to ten million ohms. Incredible, but true. Others have infinite resistance, and are condensers of capacity so high for their tiny size as to be unbelievable. Still others have three leads, and, opened, seem to be crystal detectors—understandable—but are amplifiers, which doesn't make sense. They also turn out to be nonreproducible. They are simple mechanical structures, using the very unusual element germanium, in the crystals. But the chemical expert's best purified germanium won't work when a reproduction is tried. (You've got to have the right amount of the right impurity introduced in the right way. Techniques in the '20's weren't up to it.)

Furthermore, there's a tube that's obviously a triode oscillator, but the frequency involved is so high as to be detectable only when using crystal detectors from the plane's own equipment. The circuit, too, doesn't make sense to the radio engineers, though the physicists from the Bureau of Standards finally figured it out. (It's a tuned-line oscillator operating at about four hundred megacycles. The physicists had to go back to Hertz's original work with tuned-rod oscillators to get a glimpse of what went on.) They can't reproduce the tube, and no tube they can make will oscillate in the circuit used.

Finally, there's another group of equipments they've simply agreed to forget. It seems to center around a permanent magnet of fantastic power which embraces a copper block drilled with holes of odd sizes, having a central electron-emitting rod through it. The magnetron is bad enough—obviously beyond reproduction, since the cathode can't be duplicated, the magnet can't be duplicated, and the metal-to-glass seals are beyond any available technique. But the associated equipment is worse. There is a collection of rectangular pipes made of heavy silver-plated copper. The pipes contain nothing, carry nothing, and appear totally meaningless. This time the physicists are completely stumped. (Wave-guide theory is a recent development; without some basic leads, and understanding of the order of frequen-

(*Continued on page 161*)

EXPEDITION MERCY

BY J. A. WINTER, M. D.

***Science-fiction** has discussed the dangers of savage extra-terrestrial environments, hostile animals, hostile intelligences—but here was an expedition killed off more subtly, and yet more horribly by a quite different form of attack. Sabotage, it was, in a sense—*

Illustrated by Cartier

The brazen clangor of the alarm bell reverberated through the Cupromagneloy bulkheads. "O.K., you dopes. Prepare for landing. Next stop Minotaur. End of the line. All out."

A hard flung boot narrowly missed the head of the grinning space pilot. "Save your opprobrious epithets for your brother space lice. When you speak to us doctors call us gentlemen."

"Yes, gentlemen," Tom Kelly bowed low in a mock salaam. He straightened up to the position of attention, removed his rakish Navy cap and announced in stentorian tones, "The Navy detachment in charge of the spaceship *Mercy* wishes to announce that in approxi-

mately one hour we will be the second ship to land on the planet Minotaur. And, if you pill-rollers don't get into your deceleration gear pretty quick, you'll be taking care of each other for the next month."

"Yes, admiral. We hear your words of wisdom."

In spite of this good-natured banter it was obvious that the five doctors were wasting no time in preparing themselves for the stresses of landing. This wasn't going to be an easy landing like the ones at the spaceport at Luna City or Mars Port. There would be no space tugs whose added mass would help deceleration and which could help ease them onto the landing strip. There were no spaceports on Minotaur. It was very probable that there were no men on Minotaur, in spite of the fact that Expedition I had landed there only six months ago.

Dr. Bob Edwards finished strapping himself to his bunk and sighed. "For this I went to medical school." A veteran of countless planetary landings, he knew how rigorous a landing such as they would be making could be.

"The rest of you fellows all set? Irv, better get that pad straightened out under your feet. We'll be turning in a few minutes and then you won't be able to."

The discordant jangle of the alarm bell rang out sharply again, to be followed by the high-pitched whine of the gyroscopes as the ship was rotated for her stern-first landing. Then the rockets blasted out and further speech was impossible.

The next hour was one of tense activity for the crew members, easing the ship down to her landing on the broad, vegetation-free plateau which had been chosen. For the five doctors strapped into their bunks it was a period of alternate haziness, stomach-wrenching free fall and an occasional respite of unconsciousness.

Dr. Bob, who was more accustomed to the strains of deceleration, took advantage of this period of enforced immobility by going over once again his plans for the expedition.

"Let's see, now. It was about two months before the first expedition stopped communicating. That would probably rule out any bacterial infection—too long a period of incubation. Vegetable spores? Possibly. Probably not food—those guys were certainly given strict instructions not to eat any of the plant life here."

The ability to think in straight lines, to evaluate and correlate was an integral part of Edwards' mental equipment. If he hadn't had this ability, he would never have reached the rank of Senior Synthesist in the Solarian Public Health Service. He was a Synthesist because he had the true synthetic mind—the innate ability to absorb the findings of the various specialists, arrange them in the order of importance of influence and finally come up with a diagnosis which was

accurate and not prejudiced by enthusiasm for any one specialty.

He represented the epitome of the general practitioner—a medical jack-of-all-trades and a master of them all. And even if he hadn't been appointed the leader of the medical contingent in this rescue expedition, he would have automatically been conceded first place. He was obviously, inherently and involuntarily a born leader.

"But to be on the safe side we have to keep as free from contamination as possible. We certainly have to use our own food and water; we'll have to keep on breathing this canned air until we can be sure that there are no spores. I hope our decontamination air lock is going to work all right."

A particularly violent surge from the rockets brought him to semi-consciousness, blotting out his thoughts.

The next thing Bob felt was the jar as the ship settled to the ground. He began to extricate himself from his deceleration harness, noticing that the others were doing the same.

Tom Kelly entered the room and saluted with a flourish. "Dr. Edwards, in accordance with the orders received from the Spacenavy Department I hereby end my tour of duty as commander of this expedition and pass my command to you." He grinned; it's hard to be formal with another man when you've been cooped up together in a spaceship for three months. "And be sure that you take good care of all the little boys."

"Thanks, Tom," replied Edwards. "You've done a good job so far, except for that lousy landing. Doesn't the Navy teach you how to land a ship without dismembering the passengers?"

"Now, grandfather—if I just hadn't forgotten about your brittle bones," Tom gave an exaggerated sigh. "And to think that a fragile old man like you is now CO!"

"O.K., fellas," said Bob, "let's get down to business." He could always take kidding but now there was a serious problem confronting him. "Come on and sit down and let's run through our plan of camping again. I know we've all hashed this over before, but we'll do it again. We can't afford to make any mistakes."

The members of the expedition grouped themselves around the table. Bob looked them over with a strong sense of pride in the vast medical talent represented there. In addition to himself and the Navy captain, there was Jack Livingston, one of the cleverest young surgeons of Terra, and the innovator of the practice of transplanting limbs from cadavers to the living. Sharp and incisive as his own scalpels, he was, next to Edwards, the obvious understudy for command. Then there was Irving Mandel; listed on the roll as a psychiatrist, he was actually an expert on psychosomatic

medicine, an expert linguist and a very fine musician. Sensitive to the moods of others, sweet tempered and soft spoken, he was at home and well liked in any sort of group. The specialist in internal medicine was Wilhelm Schultz—and with a name like that, he was the obvious target for nicknames; at present he answered most frequently to the labels "Bilious" and "Dutchie." He was, in addition to his abilities in the field of exotic diseases, an expert endocrinologist. He was a phenomenal diagnostician; he knew more about a patient after taking his pulse than most doctors would after a complete physical examination. He and Kelly were a lot alike in their clowning and ham acting—a good balance for the more serious members. The last one of the medical group was the pathologist, Dr. David Charles Thomas. He was especially well equipped for membership in this expedition; it was part of his professional training to be able to perform an autopsy, do chemical analyses of the blood and recognize pathogenic spore forms. His hobby of the chemistry of radioactive substances made him an even bigger asset. He was a fastidious dresser, and his words were as clipped and neat as the trim mustache on his upper lip.

Yes, thought Bob, they were good guys and formed a group that was practically unbeatable. If anyone could solve the mystery of what happened to Expedition I, they should.

"Now," said Bob, "to recapitulate. Expedition I landed here about six months ago. Their reports were, medically speaking, essentially negative until about six weeks thereafter. Then they all began having attacks of nausea, vomiting and weakness. By this time the reports were a little sketchy and lacking in the sort of detail we'd like, but we do know that at least two of the men had sustained fractures. Why they didn't have a doctor with them I don't know. Yes, Tom, I know they had a pharmacist's mate with them; the Navy does a good job of training those boys for emergencies, but they haven't the knowledge to cope with something like this."

Having thus forestalled Tom's automatic objection to any possible criticism of his beloved Navy, Edwards was able to continue.

"It is doubtful that this could be anything but some form of disease. We can discount the possibility of influence by indigenous life forms. Captain Henderson was very explicit in one of his early reports to say that they were unable to find any form of anthropoid, humanoid or even intelligent life here. Apparently Minotaur is still a baby, as planets go, and intelligent life still hasn't evolved."

"Tom, may I ask a question?" It was Irv Mandel, the psychiatrist, speaking. "I noticed you've been studying the transcript of the radio messages. Did you get any

more clues since we talked it over the last time?"

"No, I didn't, Irv. The only conclusion is the one I've been stressing right along—we *must* be careful, so careful it'll seem silly, not to expose ourselves to anything on this planet until we're completely certain it's safe."

"You're right, Tom," Livingston spoke up, "but I don't have to *like* wearing a spacesuit, and breathing this canned air. I've been breathing this same air so long I can recognize every molecule as it hits my alveoli."

"I'm afraid you'll just have to keep on greeting your little molecular friends for a while. Until we find out what happened to the others and what caused it we can't take any chances. You men realize as well as I do the sort of dangers that might exist here. There's no point in enlarging on the obvious. So my first order must be—no one is to leave this ship or to have any contact with anything on this planet unless he is specifically commanded to do so. Tom, please pass this along to the members of your crew. Now—any questions?"

There was silence in the room. Even the irrepressible Schultz hadn't any remarks to make.

Edwards stood up. "Well, we'd better get started. The first big job will go to Death-House Davey. Dr. Thomas, will you get your crew started on air analysis? And don't hesitate to do animal inoculations with any suspicious spores or bacteria. We have plenty of guinea pigs and hamsters. Schultz will help you. Tom and Irv and I will put on our rompers and go out and see what we can see. Jack, you'll be in command while we're gone. Try to restrain yourself from carving up the crew."

Jack grinned back at Edwards. He was always the recipient of good-natured chaffing for his interest in the surgical approach. "O.K., synthetic; I'll try. Be a good boy when you go out and come home immediately when Momma calls."

"Yeah," added Schultz, as the three doctors left for the laboratory, "don't forget to take a hankie with you."

In the meantime Tom had spread a pile of charts out on the table. "Here are those charts they sent us by facsimile. Apparently there's no magnetic poles here; they've specified an arbitrary North Pole at the axis of counter-clockwise rotation. They did a pretty fair job of mapping this area, too."

Bob was studying the maps with his usual intensity. "Seems very complete to me. Where are we now?"

Tom put the tip of his pencil on a point on the chart. "We're on this little plateau. The location of their base camp is about two kilometers at seventy degrees."

"Hm-m-m—we could walk it in twenty minutes or a half hour. Guess we'd better do that. No point in taking the flitter out yet."

"That's right," said Tom. "I'd

like the chance to get out and stretch my legs a little. And by the way—I'm having the boys rig direction finders on the bow and stern. The ship is lying pretty close to due north and south, so we can get our bearing by triangulation."

"Good idea, Tom. I'd hate like the devil to get lost. Well, let's get to going."

Within a few minutes the outer door of the air lock had clanged shut and the three men set their booted feet on the soil of Minotaur.

Tom's voice crackled over the intercom headsets. "Testing—one, two, three, four—are your radios O.K., gents?"

"All right."

"No trouble, I hope." This last was from Mandel, the cautious.

"O.K., Carson?" Tom was speaking to the radioman within the ship.

"Yes, sir. I have the directional beam on at azimuth 75. If you don't hear it by the time you get fifty meters from the ship, please let me know."

"All right, Carson. Turn on the recorder, and we'll put this on the tape as we go along."

They walked a short distance from the ship, then turned until the faint, regular *beep beep* of the directional beam told them they were headed correctly and started off. It seemed so silly to be wearing spacesuits. From the appearance of the landscape they might have thought that they were still on Earth, perhaps in the Washito mountain region of Oklahoma. There were some slight differences, of course. There were twin suns, quite close to each other in the sky, and the light given off gave everything a noticeably yellow tinge. And you couldn't be sure if the vegetation was made up of large plants or small trees—but a quick glance would still make one think of Earth. It seemed a shame to be cooped up in a spacesuit on a lovely, cloudless, sunny day -but they knew that death for humans was hiding on this planet. And until they could determine its hiding place —well, eternal vigilance is the price of freedom, especially freedom from death.

Gravity of Minotaur was slightly less than that of Earth, so walking, even with the encumbrance of spacesuits, was quite pleasurable. They wasted no breath on useless conversation as they strode along. The silence was broken only by occasional laconic comments on the terrain, dictated by Tom to the recording apparatus back at the ship. Once Bob saw a large flying insect, but was unable to obtain a good description of it. They saw no other living animals.

The way they took wound downward from a low plateau towards what seemed to be a watercourse lined by vegetation. They soon reached this river valley with its rich greenish soil and began walking through a field of brush. The ground was firm and springy beneath their feet. The silence was

broken only by the hiss of their respirators and the faint beeping of the beam, changing its rhythm as an occasional obstacle would force them from their course.

After about a quarter of an hour they glimpsed a shining metallic cylinder ahead of them.

Bob pointed. "There she is, fellows. Now to find out why we came on this little buggy ride."

They strode along a little faster until Tom suddenly said: "Hey, look here!"

In a little clearing stood ten markers, each set up at one end of a rectangular mound of earth. Irv bent over the nearest and read, "Herman Jesperson; died April 12, 2245." He moved over to the next. "David Carter; died April 16, 2245."

"Do you notice how each grave is progressively cruder? The first man that died had a lot of attention given to his burial; the last man was apparently just covered over. Guess that as the expedition grew weaker they just couldn't make the effort any more."

"But listen," said Tom. "There were twelve men in the expedition and there are only ten graves here. We'll have to do a little more looking."

"Yes," agreed Bob, "we'll have to come back here later."

Another few minutes brought them to the spaceship. The outer door hung open; the inner door of the space lock opened without difficulty. A few lights were still burning. That meant nothing, as the power supply on these ships was practically inexhaustible. Other than that, the first glance at the interior of the ship showed nothing remarkable. The old Navy tradition of keeping things shipshape had still operated, in spite of the illness of the crew.

"Let's look it over," said Bob. "Tom, you take the forward end, Irv the engine room and I'll plow around amidships."

A few minutes of silence, punctuated by the opening and closing of doors, then two voices spoke up simultaneously. "Here's the ship's log," reported Tom.

"Hey, there's a body here!" Irv called.

"Come on aft, Tom, and bring the log with you and we'll see what Irv has found," commanded Bob.

It wasn't a pleasant sight; the processes of putrefaction and desiccation don't make the human body a thing of beauty. It bothered Tom to look at what remained of this mass of dissolving protoplasm, and he mentally noted his thanks that he was breathing the air of his spacesuit. It would have been just too much for him to have been exposed to the odor of this corpse.

The two doctors weren't bothered, of course; they had seen human bodies in all degrees of dissolution and disrepair countless times before. But they were shocked at the appearance. The arms and legs looked as though they had been

broken in at least twenty places. The toes of one foot pointed toward the bunk, although the body was lying on its back. The body looked as if it had been twisted in the hands of a vindicative giant. And the skull was studded with numerous protuberances like warts on a schoolboy's hands.

"Are you thinking what I'm thinking?" asked Mandel.

"It sure looks like it, doesn't it?" said Bob. "Well, we can come back to this later. This is a job for Thomas—and won't he love it? Let's get out of here before our naval friend gets *mal de corpse.*"

They left the room, to Tom's complete satisfaction. "Say," said he, "while you ghouls were looking over that poor devil in there, I just glanced at the log. Look what I found."

Inside the front cover, in large, shaky, painful-looking letters were the words, "Look in refrigerator."

"I don't suppose that someone was trying to tell us that the cook left some ice cream for us," said Bob. "Maybe we'd better follow this up before going any further. Tom, where do they keep the galley on this type can?"

"It should be right in here," replied Tom, opening a door.

It was the galley. It was, as everything else on this ship, spotlessly clean and reflected efficiency in every inch of its design. Along one wall was the huge refrigerator chest used for the storage of frozen dehydrated foods. Bob strode over and gave the heavy lid a heave up and looked inside.

"Irv—Tom."

"What is it? What is it?" asked the other two as they crowded up.

Inside was another corpse. Dressed carefully in a crisp white uniform, preserved by the minus fifteen degree Centigrade cold, it was as though Death had been arrested at the moment of occurrence. It would have been prettier if it hadn't, too. The limbs gave evidence of numerous fractures, had that same twisted look that the other body had; the face still showed the dusky bluish discoloration that means asphyxiation. And a stick with a piece of string tied to it, lying beside the body, gave mute witness to the fact that he had died by slowly smothering in the dark frigid depths of the refrigerator.

"Do you have this figured the same way I do?" asked Bob. "This man, seeing that he was going the same way as the others, preferred to commit suicide in the refrigerator so that his body would be preserved for our examination. And it must have been a perfect hell for him to have gone up to the control room, written that note and then come back here and climbed in. Look at those legs—I don't see how he could have *crawled*, let alone hoist himself into this box. And once inside, he pulled the string, the stick holding up the lid came out. Boy, what guts this boy must have had!"

"He sure did," said Tom. "I know him. That's Mattson, one of

the best pharmacist's mates the Navy ever had. He was just the sort of guy who would realize that doing something like this would be a help to those who came to investigate."

"What sublime courage. Imagine—the last man on a planet, dying here alone in the cold and blackness, without air and without hope. 'Greater love hath no man—'" and Irv shook his head slowly in profound admiration.

Bob let the lid fall again with an air of finality. "We'd better just leave him there until Thomas is ready to have his post-mortem. And I guess we'll get on with our search. I'll pick up any likely looking specimens of food or liquid, and you guys pick up all the documents you can find—letters, diaries and so on. There's not much doubt about the diagnosis, but how it could happen to all these men in such a short time is beyond me."

Within a few minutes the three men were gathered outside the ship. "Did you find anything else?" Bob asked.

"Nothing very important, I guess," replied Tom. "I took a quick look at the navigation and operation charts and there's nothing out of line there, so I left them."

"I got a couple of diaries and some letters," Irv added. "The rest of the stuff was, if I may use the phrase, apparently noncontributory."

"I checked over the galley pretty closely," Bob said. "They had been eating nothing but standard food. I couldn't find any evidence of experimentation with any of the native foodstuffs. They had been using local water, however, but they had run it through a Berkefeld porcelain filter according to standard operating procedure. I brought along a specimen anyhow. Just a minute—I want to get a bottle full of river water, too."

That took just a few seconds and soon the three men were on their way back to the *Mercy*. It was noticeable that they were no longer under the strain that had weighed them down on their first walk. Now they had the terms of the problem laid out before them, had some data to work on. Like good investigators should, they shifted their minds into neutral until the data could be studied, without wasting time in circular cerebration.

"Tom," spoke up Irv, "I've often wondered, how does it happen that such anachronistic terms as 'pharmacist's mate' and 'galley' are still a part of naval vocabulary?"

"To tell you the truth," answered Tom, "I can't tell you. I suppose it's just another example of the persistence of tradition. Those names probably meant something at one time, but I've never thought to inquire."

"I'll bet that you don't know the significance of the salute, either," Bob remarked.

"That one you can't fool me on.

It's a hold over from the time when a knight would raise his vizor to identify himself as a friend—a mark of respect to someone he met."

Bob spoke up. "It's funny how your conversation ties in with what I've been thinking about. I've been mulling over the fact that disease patterns persist for even longer than traditions. If the situation here is what I suspect it is, it's a disease which was first described about 1890—more than three hundred fifty years ago."

"Are you one of those characters who says that there's nothing new under the sun?" Tom asked.

"No," replied Bob, "I wouldn't be as arbitrary as that; but it's quite obvious that men haven't changed their modes of response to pathogenic stimuli for a long, long time."

He broke off this train of thought to look ahead of him. "There's the ship again. I'd better warn them that we're in sight. Carson!"

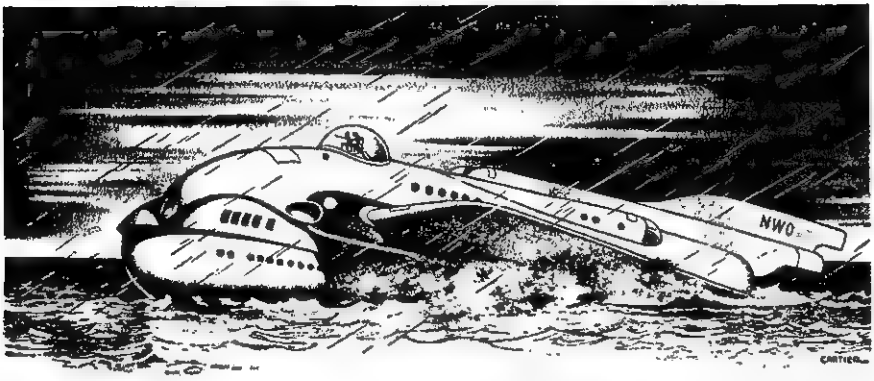
"Yessir," came back a voice over the radio.

"We're bringing back some written material that I don't want to bring aboard ship. Have the boys rig the microfilm camera at the analysis port; they'd better toss out a pager, too. We can decontaminate that easier than we can the books. And tell them that I'm bringing in some water specimens, so they can have some suction tubes hanging out. Are you all set for decontaminating us?"

"Clean up crew is standing by, sir. We'll be all ready for you."

When they reached the ship they could see a small port opened near the underside. Two short lengths of plastic tubing hung out; the blank eye-on-a-stalk of a camera gazed at the ground and nearby was a compact piece of apparatus whose function was not immediately obvious.

Bob uncapped one specimen bottle and held it up so that the tubing could reach the bottom. "Specimen number one: water used for drinking; taken from collection chamber of filter of Ship I. Take her away."



The water level in the bottle immediately descended.

"Specimen number two: water from the river near Ship I. It's yours!" And this specimen disappeared into the ship.

"Finished with suckers." A gush of antiseptic solution spewed forth from the tubing; an ingenious device clipped off the lengths of tube which protruded and the discarded ends fell to the ground. Anything which came in contact with the planet was either discarded or decontaminated.

In the meantime Irv had arranged all the loose sheets of paper under the eye of the camera, which was busily transferring what it saw on to microfilm. That task having been completed, he arranged the books on the pager. This was a device which automatically turned the pages, hesitating just long enough between turns to allow the entire page to be photographed. After making sure that the machine was working satisfactorily, he joined the others in entering the air lock.

The technicians who had perfected this arrangement for insuring that nothing foreign could be brought aboard had surpassed themselves. First, from numerous tiny openings in the ceiling, walls and floor there issued a fine mist of a detergent solution. Of low surface tension, it penetrated every nook and cranny of the spacesuits of the occupants of the lock, then fell to the floor, from whence it was ejected from the ship. Then the chamber was completely filled with a strong fluoro-mercuric-phenol solution, completely submerging the three men. They knew that their spacesuits protected them against it, and would permit them to live under water or even under nitrohydrochloric acid for days, yet they all felt that slight sense of panic and claustrophobia. Agitators began to swirl the liquid around them, cleansing every crevice, then with a *woosh* it was forced out to the ground beneath the ship. Finally the interior of this room was bathed in strong ultraviolet light at a temperature of 100° C; even with the efficient temperature regulators of the suits the men noticed the sweat droplets gathering on their foreheads and trickling down their backs.

"Well, by now we should be nice and sweet and clean," said Bob. "We don't want to bring any nasty old bugs aboard our nice clean ship."

"No, never let the fair ship *Mercy* be sullied by any indigenous stuff and things," Tom agreed.

In spite of their light-hearted attitudes, they still realized that even with all their precautions, they might be bringing Death aboard ship. And the type of Death that had caught up with the previous expedition was not one to be desired.

Having rid themselves of their spacesuits, they opened the inner door of the air lock and entered the ship, where they were greeted by the other three doctors.

"How did you make out?" asked

Livingston. "Did you see anything worth operating on?"

"There speaks Jack Livingston, the tomomaniac—nuts about cuts."

In a few succinct phrases Bob filled in the gaps of his report which had been heard over the ship's speakers. He concluded by saying: "Dave, get your autopsy kit ready and get organized to go out and examine those bodies. Jack can assist you—he'll enjoy doing some slicing even though there won't be any gore. And Bilious—"

"Zu befehl, mein Herr," replied Schultz, stiffening to a travesty of the position of attention.

"You'd better go along to observe and report. I have a sneaking suspicion that this situation is going to fall right into your favorite field of endocrinology."

"Just a suspicion, Bob? Why, any second-year medical student could make that diagnosis with his eyes closed. Tell me, does that M.S. degree of yours mean Master of Stupidity?"

"Stop your prattle, little boy," laughed Bob. "Say—if I might make a suggestion it might not be a bad idea to get some chow before you take off. By the way, Tom, how much more daylight can we expect?"

Tom consulted the clock. "It's about two hours and a half before sunset. Then there'll be about nine hours of darkness. The period of rotation is about eighteen hours Earth time."

The pathologist grunted an amorphous sound of vague disapproval. It offended his meticulous sense of the fitness of things to realize that all planets did not have a twenty-four-hour day. The entire trip was, in fact, a major dislocation of his life. The only consolation was that he had the finest laboratory equipment in the solar system. And now—he was going to get a chance to use it.

"Schultz—Livingston," he rapped out, "let's eat and get started while we still have daylight. The technicians will be up all night cutting and staining sections as it is." And he turned and left for the galley.

The others, at a more leisurely pace, followed him. It was a silent meal, with each man immersed deeply in his own thoughts, and soon finished. Like most doctors they didn't dawdle over their food; they just seemed to surround the calories like an amoeba.

After the other three doctors had finished their meal and had left for the other ship, Bob and Irv returned to the cabin and spent a couple of hours in concentrated study of the documents brought back from the ill-fated craft. Mandel made copious notes; Bob was content to read and absorb, automatically sifting out the kernels of relevant fact.

They had almost finished when Tom wandered in. "Aren't you guys ever going to get any sleep?" he asked.

"Pretty soon," answered Bob.

"What do you hear from the others?"

"They've finished with Mattson and are ready to start on the other. That guy Thomas—'we are encountering some technical difficulties due to the frozen condition of the body.' What a bunch of grave robbers I have with me this trip!"

Bob shrugged: he had long since given up expecting anything but an emotional bias against autopsies from the laity. "How else can we find out anything?"

"Guess you're right," Tom conceded. "By the way, I wouldn't be surprised if there was a storm brewing. The barometric pressure has dropped about 10 mm. in the last hour. If we were on Earth, I'd say we were due for a hurricane."

Bob pondered a moment. "I don't suppose that you have any idea of what we might expect in the line of storms."

"I'm afraid I haven't," answered Tom. "The first expedition didn't report any storms at all, but that doesn't mean that they're nonexistent here."

"Well, we can't afford to take any chances," Bob decided. "Let's go up to the radio room and talk to the boys."

They entered the radio room where a loud-speaker was crackling out the report dictated by Thomas from the other ship. The recording apparatus was spinning, making a permanent record of his findings.

"Edwards calling Livingston—Edwards calling Livingston."

"Livingston here. What's on your mind, Bob?"

"Tom tells me that there's a possibility of a storm coming up. You'd better plan on spending the night there. It might not be so smart trying to come back here in the darkness."

"O.K., if you think so," assented the surgeon. "But we'll have to get out of our spacesuits, you know."

"Huh? Why? Oh, yeah." For a moment Bob had forgotten that the problem of elimination while in a spacesuit had not been solved.

"Just a second, Jack." Bob mused for a short interval, his mind racing over the problem, weighing one possibility against another. Then, "Under the circumstances I'd still say that you should stay there. I've got a very good idea of what caused the death of those boys and I'm quite certain you'll be safer in that ship than you would outside. Just one thing, though—don't eat or drink anything that's aboard that ship."

"O.K., Bob; if you say it'll be all right, that's good enough for me."

"Hail, Edwards! We who are about to become guinea pigs salute you!" That was Schultz, of course. And his gay remark didn't make Bob feel any better. He *thought* he was right; he was *almost* certain that his advice wouldn't prove harmful, but there was still that little lingering doubt. The mantle

of responsibility is seldom a comfortable garment.

"We'll keep a man on duty at the radio at all times, fellows," concluded Bob. "Let us know if you need anything. I'm going to turn in now and I'll call you in the morning."

When Bob rolled into his bunk he fell asleep immediately. The rigors of landing, the unaccustomed exercise of the walk to the other ship and the nervous tension engendered by the problem in hand had all conspired to exhaust him. In spite of his heavy slumber, however, he was awakened during the night by the sound of rain pounding on the hull of the ship.

"There's that storm that Tom promised us," he thought sleepily. Then he realized that this must be the granddaddy of all rainstorms if he could hear it through the hull. The thick tough plating, the numerous layers of insulation and dead air spaces which were necessary to shield the crew members against the cold of interstellar space and the inferno of the suns—you couldn't hear the sound of an ordinary rain through that. But that wouldn't bother the ship—she'd be safe at the bottom of the ocean. So he rolled over and went back to sleep.

The next thing he knew, he was being shaken, not too gently, by Tom. "Whuzza matter—is it morning?" he asked drowsily.

"The clock says it is, but this is the poorest imitation of daylight I've ever seen. Come on, get up, and let's get a look outside."

With a prodigious yawn Bob clambered out of his bunk, slipped into his uniform, gave the zipper a twitch and was fully dressed.

"O.K., early bird—let's go."

Tom led the way to the observation chamber on the top of the ship. He carefully dogged down the airtight door and pressed the button which caused the outer plates of the hull to slide back, revealing the transparent ceiling. The drumming of the rain became thunderous. Tom started the pump which raised the air pressure within the room, blowing the tough, transparent and highly elastic polymer into a dome which protruded from the ship's back like a soap bubble on top of a watermelon. They took their seats in the observation chairs, which shot up until their heads were almost touching the dome.

It was difficult to remember that it wasn't necessary to flinch as the huge drops of rain, driven with machine-gun force, pelted against the dome. Visibility was no greater than fifty meters, and then only when the force of the wind abated temporarily. During the furious gusts it seemed as though they were at the bottom of some deep, murky and turbulent body of water.

"It's letting up some, now," said Tom, judiciously. "Those puffs aren't any harder than seventy kilometers an hour. During the night I'll bet the wind was better than one hundred and fifty."

"No wonder there's no humanoid life on this planet. I don't see how anything could survive this sort of weather. I'm certainly glad that I told the others to stay at the ship. How are they making out?" Bob asked.

"Pretty good, I guess," answered Tom. "Their ship is completely under water, though, and reception is rather faint. Last thing I heard clearly was that Schultz was hungry."

While they were talking the rain had gradually decreased, although the wind continued with unabated fury. For a moment the two men could see around them in a thousand meter radius. And what a sight! The plateau on which the *Mercy* was rested was now an island. Vast torrents of water swirled around the base of the outcrop. There might have been waves—but every time a crest of water tried to rear itself, its top was amputated by the screaming knife of the wind and hurled into the dimness which lay beyond their field of vision. The vegetation which had carpeted the floor of the valley was totally submerged.

They had just a glimpse of their surroundings, then the rain began again. It pounded with mighty fists against the dome while the wind screamed a challenge to the puny humans who dared to challenge its might by their presence.

"Dr. Edwards," said Tom, "it looks as if we might have a heavy dew one of these days."

"I agree," answered Bob gravely. "The weather appears to be a mite threatening—inclement, you might say."

He took a deep breath, then exhaled slowly; annoyance, frustration and concern for the welfare of his men were all inherent in that sigh. "Guess that there's nothing to do but relax and wait for this storm to subside. There's one consolation—we'll all be safe inside."

The next three days of enforced idleness were much worse, by far, than the months consumed in traversing deep space. Bob and Irv played chess; they studied and restudied the records from the other ship; they wandered in and out of the laboratory, suggesting further tests to be run on the specimens of water of Minotaur; and at least three or four times a day they inflated the dome and looked out at the climatic convulsions of Minotaur. To make matters less endurable they were no longer in communication with the men in the other ship; the suit radios were not powerful enough to penetrate the water in which the ship was submerged. They might have used the ship's communications system, but no one of the doctors was enough of a radio expert to operate it.

But finally the rain stopped, the wind ceased to howl like a demented banshee and the sunlight made a hesitant and apologetic appearance. The flood waters subsided rapidly and soon the radio carried the wel-

come words, "We're on our way back!"

"And be sure to have some food ready for us," added Schultz.

Bob, with a noble effort, refrained from asking any questions until his colleagues had been fed to the bursting point. Then Livingston began his report.

"That was quite an experience—being under water in a spaceship. It wasn't too bad, though. The only time when it looked as if it might be a little tough was when we ran out of water."

"You didn't drink any of the native water, I hope," said Bob anxiously.

"Well, not exactly. We talked it over for some time before deciding what would be best to do. We didn't believe that filtration would be safe, and we weren't even quite sure about how safe distillation would be. So we finally rigged up a gadget for electrolysis and then recombined the hydrogen and oxygen. There was plenty of power on the ship, so it wasn't difficult."

"Good boy," said Bob. "I'm sure that that's a safe method. Well, we'd better get to work. I don't suppose that you're tired—you've had nothing to do but sleep for the last three days. Davey, how long will it take you to get your sections stained and studied?"

"About two hours, Bob," replied the pathologist. "We can eliminate the study of the noncontributory tissues."

"Then let's plan on having a conference in about two hours. Maybe we can lick this problem today."

At the end of the appointed interval the group gathered around the table in the main cabin again.

Bob began, "I think that we all have a pretty good idea of what caused the deaths of the first expedition but for the sake of the record we'll start reviewing the evidence. Irv, tell the boys about the documents we studied. What did you get out of them?"

"The evidence from all sources is pretty consistent, with allowances made for differing degrees of accuracy of observation. The first complaints were noted about a month after landing and consisted in muscular weakness and extreme fatigability. Most of the men complained of pain and tenderness in the muscles and bones. They became apathetic, and as a consequence the task of exploring the planet was given up. It must have taken all their energy just to do routine work around the ship. Most of the men suffered a loss of appetite and several of them had numerous seizures of severe abdominal pain and vomiting. The captain realized, after it was too late, that he should have asked for help or tried to leave the planet, but he was apparently just too weak to attempt the effort. And that's all there was of interest, medically speaking. From the standpoint of heroic courage, however—well, these records beat anything I've ever heard of. This Expedi-

tion I—and I say this without any attempt to be flowery—should be an inspiration to all spacemen."

"Thanks, Mandel," said Bob. "I agree with you. And I'll make that as strong as possible in my report. Now, Livingston, I'll ask you what you boys found on autopsy."

"Well," began Jack, "you all saw the gross appearance of the two bodies—numerous fractures of the extremities. The salient points of diagnosis were the softening and fragility of the bones, areas of decalcification, and cystic degeneration of the bones of the skull. There were numerous areas of calcification in muscles and organs and large calculi in the kidneys. We couldn't determine the immediate cause of death in the unidentified body; it was too far gone. In the case of Mattson, of course, it was anoxemia."

"That certainly substantiates my suspicions," Bob said. "O.K., Davey, now maybe you'd give us the laboratory findings."

"There were only a few tests I thought were necessary to confirm the diagnosis. The blood calcium was 18 mgm. per 100 cc. and the blood phosphorus was 2.5 mgm. I cut a few frozen sections but didn't see anything of interest." Dr. Thomas leaned back in his chair again; his reports were always noteworthy for their briefness.

"Now, Schultzie," said Bob. "This disease looks like your baby. Suppose you tell us all about it."

"We've all been beating around the bush," said Schultz, "acting as though we were afraid to give this disease a name. You all know what it is—it's hyperparathyroidism. There, I've said it and I'm glad. Glad, do you hear me? Glad!"

A round of applause greeted this ham acting. Schultz was always good for a laugh.

"But seriously, fellows. These are typical cases of osteitis fibrosa cystica which we know is due to hyperparathyroidism. The funny thing about it, though, is that there were no changes in the parathyroids. How do you explain that, O Senior Synthesist?"

Bob pondered awhile before answering. "The only possible answer I can see to that is that the oversupply of parathyroid hormone came from the outside. Since it is an unusual disease on Earth, aboard spaceships and on the other inhabited planets I think we are safe in assuming that something here on this planet caused it. Thomas, how about giving us your report on the analysis of the atmosphere?"

"It certainly is nothing spectacular," answered Thomas. "All the gases here are within two percent of the values found on Earth. The carbon dioxide content is a little lower; that's probably due to the fact that no men are cluttering up the planet. There is no evidence of radioactivity in excess of what we can tolerate. The cosmic ray concentration is likewise low. As far as I'm concerned this air is completely nontoxic."

"You're probably right, Davey," Bob said. "Oh, by the way, you didn't mention bacteria content. What about that?"

"I didn't mention air-borne bacteria because there weren't any. If it weren't for the fact that there are twelve dead men out there to disprove it, I'd say that this was an unusually healthful place to live."

Again Bob pondered for awhile. "What about those water specimens I brought in—anything unusual in them?"

"Well, now, there might be. Mineral content is low. Bacteria count is practically negligible. The coloration is due to the presence of what might be called diatoms which, of course, are not seen in the specimen that had been filtered. The only unusual thing is the presence of a substance similar to albumen; very probably protein in nature. It's there in sufficient concentration to give a positive nitric acid ring test with both specimens."

"That," said Bob, "is the crux of the entire problem. We have to find out what that substance is before we do anything else. And incidentally, that's why I was so insistent that you didn't drink any of the local water."

"Did you do any more work on this while we were gone?" asked Thomas.

"No, Davey," Bob replied, "I wanted to give you a chance to use your favorite gillhickey. I thought we could inject a few animals with the water and put them in the metabolic accelerator and see what happens."

"Just a minute, Bob," Tom interrupted, "I've managed to keep my head above water so far, in spite of all the technical terms you've been throwing around. But would you mind telling a poor broken-down spacedog what is a metabolic accelerator?"

Bob laughed. "I don't wonder you've never heard about that. There are only two models in existence and we have one of them. It's a fancy sort of incubator in which you can, by controlling temperature, humidity, glandular function and numerous other factors, speed up the rate of living. You can literally make an animal live its entire life span in less than a week. Some bright boys who were doing mutation research figured that they could get the answers a lot faster if the animals would live faster. I've seen it a few times and it's really startling to see a cat put in there and die of old age in less than a week."

"Hm-m-m, quite a gadget," said Tom.

"It sure is," replied Bob, "and if it works it'll speed things up for us. Remember, it took the men of Expedition I about six weeks to develop their illness. If we're on the right track, we ought to be able to reproduce that effect in guinea pigs in about half an hour."

By the time Tom and Bob had reached the laboratory the other men were already there. A technician was just entering the room with a box in which there were eight of the world's most stupid animal, the guinea pig.

"How many are you going to use, Dave?" asked Bob.

"I thought that eight would be good to start with. We'll inject two with straight river water and two with the filtered water you brought. I had one of the boys distill some of the river water and we'll see what that does. And, of course, we'll use two more for controls."

"Here's an idea. Why don't you give the water intraperitoneally by drip? If we just give 'em one shot of water, that wouldn't imitate the continuous exposure that the men had."

"You're right, Bob," answered the pathologist. "How about you fellows helping to expose the femorals on these pigs?"

And so for the next little while the five doctors were busy immo-

bilizing the guinea pigs, each on his own board. An incision was made in the groin and the femoral vein isolated and a cannula inserted. Through this tiny tube would flow the concentrated nutrient solution; at the rate at which metabolism would proceed the animals would starve to death in a few minutes unless their diet was augmented. They wouldn't be able to eat fast enough to keep up with tissue catabolism. The solution also contained thyroxin, testosterone, estradiol, a mixture of the adrenal corticosteroids plus a delicately adjusted amount of the pituitary trophins.

At last the guinea pigs were completely prepared and were placed in the capacious maw of the machine. Connections were made for the intravenous and the intraperitoneal solutions. Then the doors were closed and the switches thrown.

It seemed as though that next half-hour would never end. The dials were scrutinized every five seconds, innumerable cigarettes were smoked—three puffs and the butts ground out—and they all but pushed the second hand of the clock. But at last the time was up and the machine was opened. The eight trays were put out on a table.

Thomas studied the labels. "Pigs one and two—river water—both dead. Pig three—filtered water—dead. Pig four—likewise filtered water—alive . . . no, dead. Pigs five and six—distilled water—old but healthy. Pigs seven and eight—controls—old but healthy. O.K., men, let's do a bunch of autopsies."

Tom and Irv looked on while the other four men opened up the little furry bodies and examined them.

Bob finally got up, washed and dried his hands, lit a cigarette and leaned back against the table. The smoke drifted up before his face as he squinted his eyes and spoke slowly.

"Well, fellows, I guess that's that. We'll have to do a little more work in confirmation of our findings here, but I think you'll all agree that the source of this parathyroid-hormone-like substance is the river water. It'll be one very sweet problem to determine the exact structure of this stuff. Just as a guess, I'll bet that its structural formula isn't anything like that of parathormone. It'll probably be like diethyl stilbestrol and estradiol—same physiologic effect, but entirely different structure. And then'll come the job of determining the source of the stuff. It looks like we're going to be ecologists and biochemists for a while, instead of M.D.s."

He sighed and shifted his position. "So I suppose that if we want to go running around outside without spacesuits that we can do it. Tom, be sure to warn the men in the crew that under no circumstances are they to drink any water on this planet unless we've checked it first."

He sighed again. "This is so anticlimatic. Well, that's the way it goes. That was nice work, boys.

Now we can take it easy for a while until we get orders from Earth. Tommy my boy, let's get at that radio."

The message was soon coded and sent. While they were waiting for the necessary twenty minutes to elapse between sending the message and getting a confirmation of reception, Tom started quizzing Bob.

"Doc, that was a very swell piece of work. It beats me how you guys can do it—but I suppose that you wonder how I can calculate a trans-orbital course, too. But how can it be so easy?"

"Tommy, you will now receive Dr. Edwards' famous indoctrination course on how not to be surprised at exotic diseases. There can't be any new diseases. You see, the human organism is capable of acting in only certain ways. For example, the blood pressure can go up, it can come down or it can remain the same. The temperature can be elevated, it can be subnormal, or it can be normal. And so it goes for every function of the body—it can change only within the limits of its own capacity to function.

"When we study exotic diseases the difficulty, therefore, is to find the causative agent. The disease itself is probably greatly similar to one with which we have been familiar on Earth for hundreds of years."

"Oh, I see," said Tom. "The roads it may travel on might be new, but it's still the same old model that's doing the traveling."

"Exactly," replied Bob. "To give you another example: the body is capable of only certain color changes. The skin might turn brown, due to the presence of melanin, one of the normally found pigments. Or it might turn any one of the colors seen in the degradation of hemoglobin. You know, those fascinating color changes of dark blue to green to yellow and all shades in between that you see in a bruise—or in that shiner that I saw you wearing last year.

"No," he continued, without giving Tom a chance to explain that he got the black eye from bumping into a door in the dark, "we could never expect to see a man turn an aquamarine blue. There just isn't a precursor for that color in the body. So we'll never see an exotic disease where the skin is aquamarine or we'll never see a disease where a man reacts outside of the normal limitations of response."

"So that's it," mused Tom. "Yes, what is it?" He turned around as a knock came at the door.

It was one of the crew members. "Sorry to interrupt, sir, but I'd like to have Dr. Edwards take a look at me. My skin is kind of a funny color."

Edwards turned around. Like the Bay of Naples on a sunny day, or Lake Superior in July, the man's skin was a beautiful, vivid aquamarine blue.

THE END

THE LOVE OF HEAVEN

BY THEODORE STURGEON

For them, the love of the worldly things, and the love of Heaven were much alike —in that they were forever untouchable!

Illustrated by Cartier

Warner stepped over the moon-washed outcropping and cast about for the Danby Trail. Fellow trotted past him, stood and sniffed the hot, dark air, and looked up and back at Warner.

He leaned down and clapped the collie's shoulder. "You know where it is, dogface," he grinned. "Quit stalling. Let's go!"

The dog waited, and when he took a step forward, ran ahead to the black mouth of the forest trail. "Half hound, half homing pigeon," muttered Warner, and followed.

He stepped into the shadows and hesitated a moment, blinking, shifting the strap of his carbine to let his sticky shoulder breathe. "Fellow!"

Fellow's rumbling growl answered him.

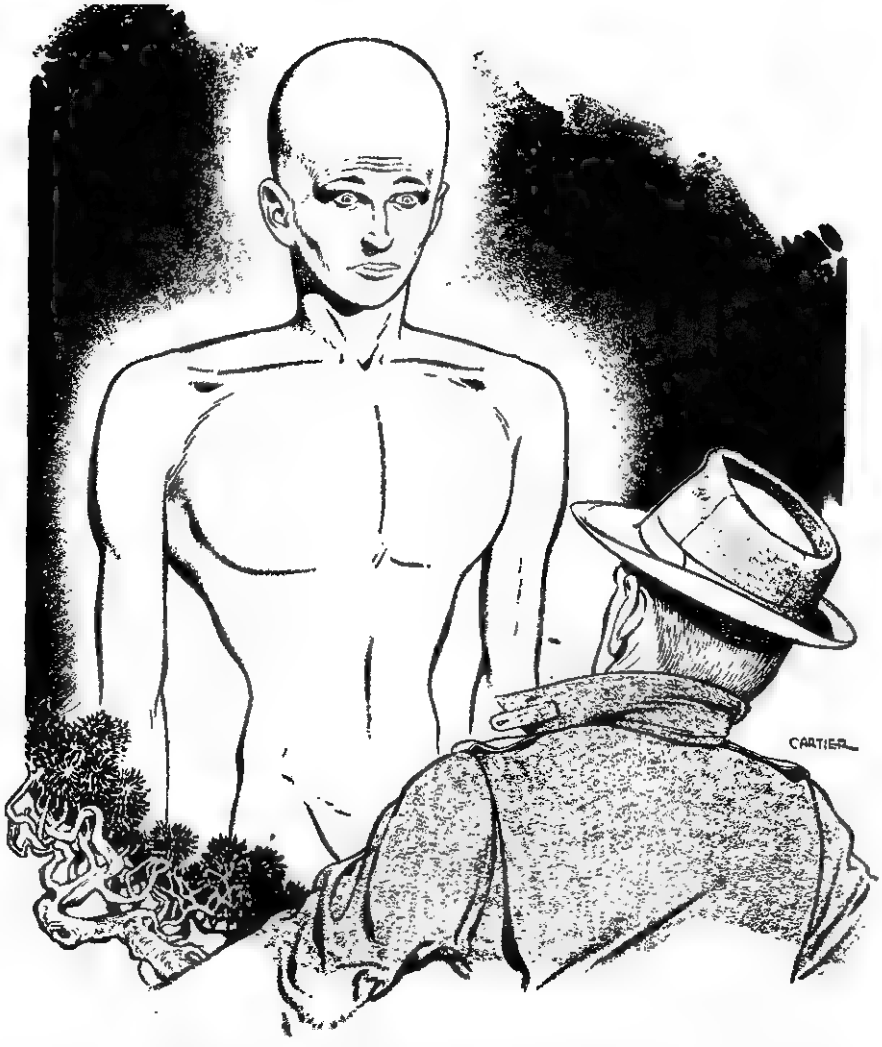
Warner was quite familiar with Fellow's vocabulary; there were barks, yaps, whimpers and growls, and variations of all. He had heard this growl before—not often, but not to be ignored. Once it was a wildcat flattened on a limb above him. Once it was an impending ice slide. And once it was a man, crouched in the shadows of his porch, waiting for him after one of these night hunts. All three were killers. Warner was still very much alive.

Eyes wide, pupils round in the velvet dark, Warner stepped forward with the sliding, silent stride of the forester. His toe touched the dog. Slowly he half-knelt, and ran his hand over Fellow's quivering back. The collie was tense, low on the ground. Warner's hand felt the flattened ears, the curled lips.

"What is it, boy?"

Again there was the ominous rumble. Warner strained his eyes in the direction indicated by the dog's straining, sensitive nose. There was nothing to be seen but blackness, and a faint oval of moonlight somewhere off the trail.

Fellow inched forward, then was



still again. Warner looked uselessly down at him, and, because it was the only thing to look at, back at the patch of light.

It moved.

Warner's back hair prickled. His tongue drove against his lower teeth, his nostrils flared, and a cold ball of terror nestled below his heart.

Moonlight has no face. Moonlight does not move toward you silently, taking shapes as it passes underbrush. Moonlight does not stand

before you, looking like a naked man.

It stood looking at him, glowing softly. It was six and a half feet tall, too wide at the shoulder, too narrow at the hips, with arms and legs too thin and a head not too large, but too high.

But its face . . .

It wore an expression of indescribable grief. Its face spoke of loss too great to bear, of the incontrovertible end of some great, sustaining hope. The despair was lined and underlined by the strength of that face. It was the face of a conqueror and of a sage, molded of the clay of power and understanding. And it was utterly defeated.

Warner was not an imaginative man, and he was schooled to danger. His frozen mind broke free almost instantly and told him *it's a ghost!*—for there was no time for any careful analysis, any testing of improbabilities.

"Control it," said the ghost, and pointed at Fellow, who snarled.

Warner's mind was more free than his tongue. His mind formed a demanding question, and his mouth managed only an interrogative grunt. And before he could lick his lips and reform them, Fellow was away from him and in midair, his long jaws hungry for the phantom's throat.

The apparition turned easily, bent backwards from the hips, and Fellow hurtled by, his teeth castanetting together. He squirmed around and landed facing the ghost, which watched calmly. Fellow snarled softly—it was like a purr—and bunched his feet together. The ghost braced its legs, ready for another spring. But Fellow did not spring. Close to the ground, he charged at the long, slender legs. The ghost dodged the dog's teeth, but could not move quite fast enough to avoid the furry flank, which thumped the calf of its leg.

Fellow spun to attack again—and kept spinning. He yelped and snapped viciously at his side. Close enough to the glowing figure to be visible by its strange light, Fellow bent like a caterpillar with a fire ant in its side, and crabbed away into the darkness, biting himself with teeth afroth in sudden foam; and he whimpered like a sick and pain-racked child.

"Fellow!"

The dog cried, somewhere in the darkness. Warner leapt toward the sound, caught his foot in a root and fell heavily. Oddly, his right hand turned under him and was driven into his solar plexus as he fell on it. The breath rushed out of him, and for seconds he lay helpless, frightened, and furious, saying "Uh! Uh!" through his knotted windpipe.

Then he could see again, because the specter had moved between him and the dog. Fellow was on his back, kicking feebly. The dog turned on his side once more, bit again at his quarter, and suddenly lay still. His eyes were open and

rolled up, his tongue out, bloody, bitten half through.

Warner got to his knees.

"Do not touch it," said the ghost warningly.

Warner looked up at it. "You killed him," he whispered, and in one smooth motion shouldered out of the strap of his carbine and raised it.

The ghost disappeared.

I've gone blind, thought Warner. He stood up, knees flexed, head low, the carbine at the ready, prepared to snap a bullet at anything, or the sound of anything.

His chest began to hurt, and he remembered to breathe.

There was silence, and blackness, fear and fury, and the warm barrel on the heel of his left thumb, the formed grip of the stock embracing each of three right fingers. He turned his head slowly, turned from the waist, from the ankles, around and back, waiting, tense. The blackness was too much, too close. He raised his eyes up, and farther up, until he could see the ghostly second reflection of moonlight on the roof of leaves above. The dim, elusive light was good.

There was a faint sound to his right. The carbine breech came up to his cheek. Silence.

He blew from his nostrils. "*Move,* damn you!"

Something moved. Something whirred and thrashed in the underbrush. Warner fired three times, the gun snuggling more affectionately to shoulder and cheek each time.

Silence again. He lowered the gun to be free to turn his head. It was wrenched out of his unsuspecting fingers. He grabbed wildly at it, clutching nothing, and staggered. He whirled, whirled again, all but seeing the certain flash, feeling the inevitable thump of his own lead into his body. He dropped, then, and lay still, the way he had done at Tulagi.

There was light behind and above him. He cringed from it, gasping, dove for a dimly-seen trunk, and crouched behind it, not looking at the light until he had cover.

The ghost was standing twenty feet away, holding his carbine easily, watching him. He ducked back. Nothing happened. The light did not waver.

He peeped out again. The ghost stood there watching him with its tragic, wise eyes. It held the carbine at its hip, not aiming directly at him, certainly not aiming away. He knew it saw him, but it made no move. Looking at the strange, sad figure, Warner felt that it would wait there all night—all week. Time seemed to have nothing to do with that not-old, not-young, infinitely patient face.

Warner pressed his lips together, cleared his throat.

"Who are you?" he asked hoarsely.

The ghost answered, "I am—" It paused, searching Warner's face,

hesitating as if choosing exactly the right word. "I am—regret."

"Regret?" Wild, extraneous references tumbled through Warner's brain. *"I am the ghost of Christmas Past"*—the masks of Comedy and Tragedy painted on the proscenium of his college auditorium. Mister Coffee-Nerves. What mummery was this?

The ghost was trying again. Warner could sense the effort for accuracy. "Not regret. I am—sorry. I am sorry your dog is death. Your dog is dead."

"Who are you?" barked Warner.

The ghost again searched his face. "I am you," it said, and waited. "No," it said, and muttered to itself, "I, you, he. It." It looked at Warner. "It is I," and it struck its chest with the carbine barrel.

Warner licked his lips. He could not know what this glowing thing was, but it was obviously demented. He asked: "Are you going to shoot me?"

"Shoot," said the ghost. "Shoot me." It looked suddenly at the carbine, as if it had just understood the reference. "Not shoot. Not you dead. Not . . . shoot . . . you . . . dead."

That's nice to know, thought Warner sardonically. *It'd be even nicer if he put the gun down.*

"Yes," said the ghost. It turned, leaned the carbine carefully against a tree, and walked a pace or two away. "Now you—" and it pointed to the ground in front of Warner's tree.

"You want me to come out?"

"Come out."

Warner considered carefully. He had no idea of the capabilities of this weird creature, but it seemed human, or near enough to being human that it might be possible to fool it. If he could keep it in conversation long enough, he might be able to edge over and get his hands on the carbine and, in two senses, put an end to this nightmare. He came out.

"You not. You not . . . can not . . . get gun, get the gun. A, an, the, some, them, those," said the ghost. "What those? What are those?"

"What?"

"A, an, the, and those."

"Oh. Articles, I guess you mean. You don't speak much English?"

The creature made that strange search of his face again. "Specific," it said suddenly. "Make general. What are 'a, an, the, dog, gun?'"

"Words," said Warner after a puzzled pause.

"Words," said the ghost. "Good. Words. Say me . . . say to me . . . tell . . . teach words to me."

Warner looked briefly at the carbine leaning against the tree. Fifteen, sixteen feet . . . a sudden lunge might do it. He might have to grapple for a second, but—

"Do not touch gun," said the ghost.

In spite of himself, Warner almost grinned. "What are you—a mind reader?"

"I read. I hear-see-read. Mind,

yes. I read mind. I read your mind. You make . . . make—" He gazed at Warner's face. "You think, I read. Yes."

"Telepathy," said Warner informatively.

"Yes. Telepathy. You send, I . . . I "

"Receive?"

"Yes. You send, I receive. I send, you not receive."

"Why?"

"You not . . . not . . . you can not. I can. You . . . man? Yes. You are a man. I are . . . am . . . I am not a man."

Warner's unquenchable humor curled to the surface. "You're kidding," he said, and to his astonishment the creature laughed uproariously.

"Give me general word, man."

"Gen . . . oh. Human."

"Yes. You are human. I am not human."

"What are you?"

Again one of those searches. "Different," it said finally. "Human, but different . . . kind." It turned suddenly and pulled up a shrub, deftly stripping it down to a stem and a fork. It searched him again—the process was quite without sensation to Warner—and, pointing to the stem, said: "This is primate." One long luminous finger ran up a side branch. "This is human, you." Indicating the other branch, "This human, me."

"Oh. You're a mutation."

"Yes. No."

"Maybe?"

"Maybe. Maybe you are a mutation."

"I don't understand."

The creature put its finger on the crotch of the stick. "Fifteens—Fifteen hundreds generations past . . . back . . . ago."

"You mean the race branched fifteen hundred generations ago?"

"Yes. My generations. Long ones. One of me is three of you."

Warner translated this for himself: "Forty-five hundred generations ago the human race branched into your kind and my kind. That right?"

"Right."

"Then where on earth have you been all this time?"

"Not on earth."

"Oh—ho! The Man from Mars!"

"Not Mars," said the specter seriously. "Not a planet of this sun. Human can not live on this sun's planets except this one."

"Where is it, then?"

It tried; he could see it trying. Suddenly he understood the searching process; the creature could get a word, or an idea, more easily if he brought it up to the surface of his mind. He visualized a star map; the ghost made an impatient sound. Warner's lips twitched; he had always had a very bad memory. He visualized the night sky.

"Yes," said the glowing man.

Warner thought of constellations; of the Cross, and Lyra, Scorpio, Sirius, and the Hyades. And when he visualized the Seven Sisters, the

Pleiades, the ghost exclaimed. Warner could not remember how the Pleiades were placed, exactly, but he knew that five of the major stars were easily visible, the sixth fainter, and the seventh invisible except to the very best eyesight.

"Yes. Faint one," said the ghost. "But is not one star. Is many. In not one group of stars; you see through stars near a line from here to there. My planet is not of faint Pleiades Sister; is through it, far away on other side. You are thinking about the gun again. Do not touch it."

Warner swore.

"Your dog is dead," said the glowing man. "I did not want to dead . . . to kill your dog. You are the first man for me here. I not . . . did not know you can . . . could not hear-receive me. I heard you. I talked-thought to you. I told you to meet me. I told you not to touch me. Your dog flew to me. I not . . . did not want your dog to touch me. He would dead himself if he touch me. You will dead yourself if you touch me. Your dog is dead. I am sorry. I do not want you to be dead. I will be too sorry if you are dead. When I understand that you can not hear me except me . . . I speak, I went . . . dark and took away gun. Human with weapon never think."

Now I get sociological truths, thought Warner wryly. "Why will you kill me if I touch you?" he asked.

"Kill," said the other, and looked at his face. "Kill, die, murder, execute, slaughter. No. I will not kill you if you touch me. Kill is what you do with . . . with desire, yes. I say a different thing. I say if you touch me you will die. I am sorry your dog is dead. I am more sorry if you are dead. I do not desire you dead. My . . . me . . . I am—"

"Poison?"

"Yes, poison. Poison. Almost all Earth things I poison. Very . . . fast." And again came that surge of tragedy across the strange, tall face. "All things of Earth. All living things—" It still held the forked twig; it looked at it sadly and, without throwing it, with a gesture of will-lessness, let it slip from between its fingers to the ground. "That would be dead now, without . . . even . . . even if I did not break and pull away leaves. Just to touch it— My . . . my feet . . . footprints are dead places."

"But why? Why do you do it?"

"Why? I do not do it! I do not make and spread poison! I *am* poison!"

"I don't understand. What are you doing here? Why stay here if you kill everything you touch?"

"I will . . . try. If you do not understand, tell me to . . . to stop.

"We are different humans, and this is our place where we began . . . this, this planet. We grew fast and got . . . gained—"

"Evolved?"

"Evolved very fast, yes. We

made a . . . tools . . . machines . . . Think of men building. Think of what men must have to build. Yes! Yes. Intelligence. Logic. Intuition? Yes, intuition? Yes, intuition too. We understood each other well. You do not understand each other. You work with you, he works with he. If you work together, you will build, but you are . . . important. Or he is important. With us, the building was important. Thirty generations made us free from . . . from things outside us."

"Environment?"

"Yes. Free. To have a . . . problem was to find the way . . . the way to solve it. It was . . . different evolution. Evolution in plants, in animals, is try this, try that, this is good, that is no good, what is no good dies. We were different. We tried only what would be good, what would build. Understand?"

"I think so," said Warner. "We have built more in the last three hundred years than we did in the three thousand before that."

"Yes. It was the way, the way we began. We lived in a valley. We lived long, each of us, and very close. We were always few. We did not go to all the earth, like you-men. We stayed in our warm valley-bottom and built. We did not build cities like you-men. We did not need them. We built inside"—it touched its head—"and a few machines, when we needed them. Then came a time when we knew our valley would be killed by the sea. It was below the sea. There was a thin mountain at the end, and it would break and the sea would come in.

"Some did not care. Some moved farther inland to be saved, and we never heard about them again. A few made a machine, and left this planet."

"A spaceship!"

"Not a ship. Not like the picture you are thinking. It would be good if you could hear . . . see my thinks. No, it was a machine. It made . . . solid things not-solid, and then made them solid again somewhere else. The me-men, and some women, went in the machine and the machine went away from this planet.

"The machine was built to . . . to seek a planet like this one; this heavy, this warm, with this air. It went far."

"Did it take long?"

"There is no take-long in such a machine. It is not understood. No man has gone in the machine for a little way. Only a long way. I am the first to go away and to come back. To be in the machine is to set the part which seeks, and to start the machine. Then the machine is there. To be outside the machine is to watch it . . . disappear. It is not known if it will come back soon, or fast, or not. Or not come back. I may come back when and where I left. Or later . . . large later."

"Why have you come?"

"When me-men left this planet,

the machine found another. It was like this and not like this. It was more warm. It was more dark. The Sun had more . . . more—"

"Radiation?"

"Not more. Different. We had mutation, some mutation. Not much. This—" and, shockingly, the light went out again. And came back. "Like small animal . . . insect . . . like firefly. Cold light. At will. But that was many generations.

"A thing happened. The machine came to that planet and broke. It is not understood what happened. Some dies then. The others made a place to live. Many more died. The plants were not right. The plants were the same building . . . the same . . . the same chemically as here. The animals were the same." A questing pause. "Colloidal. Carbohydrates. Yes. But a small different—

"Think of a thing, to give me the words . . . a thing you eat, or you put inside you, and it makes you happy, or it makes you move fast, or it is a poison, or you sleep."

"Drugs?"

"Yes. Drugs. Not drugs. Like drugs. What can you make inside you that will do these things?"

"I don't think I . . . hold on! Hormones?"

"Yes, yes, hormones. Plants make poisons to make animals sick, so the animals will not eat the plants. Some plants are always poison because no animal can make the same poison or the . . . the . . . antidote? Yes, antidote, but also the thing that makes the animal strong to the poison."

"You mean the animal gets a high enough tolerance for the poison so that the poison is harmless."

"Yes. Plants make hormone poisons; animals make hormones for tolerance. Yes. When me-men lived first on that planet they had no tolerance. Many died. Grass, trees, common, just like this"—the luminous hand waved—"were poison. Animals which ate those plants were poisoned. Most of the me-men died. Some did not."

"Survival of the fittest," said Warner unnecessarily.

"Not a law," said the creature, as if it had found a blue cigarette in a box of white ones. "A balance. A balance in fluxes.

"What was left was few, sick, weak. Necessary to fight hard to live. They became fewer every generation for too long. They lost the . . . the . . . thinks, the way to make machines, the big simple thinks behind the way to make machines. A long time before they were strong again, and when they were strong they were different.

"They knew they changed. But they knew where they came from, and that they were once strong, and they cared for the strength. For the many generations they were weak and sick and few, they held to one big thing—this planet, this Earth. This was the Beginning, this was the Source. For long, long, they had nothing great but this one

think. They felt hard about it. They—"

"A religion?"

The other studied the word as it flowed from the convolutions of Warner's brain. "Like religion. You have in you some . . . things—Think of the things you can not touch with your hands, things which are big. Yes. Yes— Religion, and more. Love. Pride. Courage. What is this one? Self-respect? Yes, we have that, but not self . . . selves . . . the thing me-men had was like all those in one central feeling, and all felt the same and could share. Earth was our greatness, and it would be our goal. A man, any kind of man, builds on a simple strong thing—an idea or a rock or a natural force. Earth was the thing of greatness to us, the source of our strength and the strength that we held when we were weak. We are strong again; we built strong, and we built around the idea of Earth. The thing we worked for was to be wise enough again to build another traveling machine. We did. A small one. Big for one. Big enough for—me."

"We have had civilizations like that," said Warner thoughtfully. "Civilizations in which the government and the religion was the same, where customs and laws all sprang from worship."

"Worship. This was not worship."

"It wasn't? Sounds like Shinto to me," said Warner bluntly. "Ancestor-worship."

"Wrong," said the other, just as bluntly. "When we were weak, we were great, because we were great when we were strong. We were same thing, weak or strong, before and now. We were . . . are great. Ancestor worship is all in the past. We were . . . are . . . will be great. And Earth is at the beginning, and Earth is at the end." And again the tragedy swept that strange face.

"We have had trouble with races which thought they were better than any other," said Warner, his distaste evident.

"Better? You understand small things only. No me-man compares with other groups. A tree is a great tree because it does the most a tree can do, and it is no greater than a great grass. I hear . . . see a thing in you . . . yes. I see it. We do not fight against ourselves. Is the difference between us."

Warner's fear had long been replaced by curiosity, and then by wonder. For the first time he began to feel a respect. After a time he asked: "What are you going to do?"

"I shall go back," said the creature. "I shall go back and tell them that Earth is here, and that it is as the legends and records say, and that we can never come back. When I tell them that it will melt the . . . bones of our building."

Warner said: "For years many of us have worshiped in a way which includes a Paradise, a Heaven; and along with it the conviction that we can never achieve it in the flesh.

That is, we go there when we die."

"That is not for us. Earth is our Paradise, I think; but it is one to be reached by us with our hands and legs and shoulders, to walk on, to live in, to be a part with. And if we come we must kill it."

Warner's mouth was dry. "The poison—it doesn't work both ways? The plants of your planet killed you. Now you have changed. Wouldn't Earth kill you?"

"No. We were harmless to our plants, but they killed us. We kill Earth things, but they can not harm us."

"Then why can't you come?"

"Because Earth is Earth, and we can not kill it."

"You mean you are not strong enough to kill it?"

"No. We are strong enough. We are a terrible enemy. We are like you, but we are like you thinking alike, and together. We could come and kill everything, and bring our plants and animals, and have the Earth."

"I don't understand. You seem to be difficult to stop once you want something. Why don't you come?"

The glowing stranger looked at him for a long time, quietly. "We rule our planet, and we despise it. When we lived on Earth, we were a part of Earth. We do not want Earth as a part of us; and we may have it no other way."

"Your tradition is that strong?"

"The bones of our building," said the creature again. "The base, the core, the beginning, the end, and the goal."

Warner shrugged. "You will have to find something new, then."

"We will die first."

And Warner knew that that was not a figure of speech.

Warner came back the next morning, to bury his dog. He concentrated on the things he was doing; the steps he took, the bite and lift and throw of his shovel, the gloved meticulousness with which he sponged off his carbine with a rag soaked in the bottle of bleach he brought with him. He was aware that he had given and received a farewell last night, and that he had been told about the bleach, and that, to the stranger, it simply did not matter whether he told his story or not. It could not matter.

These things were too much a part of that other experience, the thing which happened after the stranger's light went out, after five quiet minutes during which Warner sat in the blackness thinking nothing, nothing at all, just watching his etched memory of the shining, grieving face.

Then there had been that glare of red, and he had floundered and stumbled to it, to see the stranger sitting in a simple chair, clean-lined, hooded, with some barely-glimpsed controls on one desklike arm. The stranger was distorted, spread, flattened and—curved, curved like the surface of a sphere,

going back and away, but in directions which could not be followed. Then the light was a whirpool of incandescent blood, its inner surface dwindling away like a Dalinese perspective, its remote convergence a speck of glittering scarlet shaped like the stranger and his chair, tiny, or distant. Warner was numb, shocked, blasted by the enormity of that indescribable *direction.*

Therefore he concentrated on the simple, solid things he had to do—burying, cleaning, walking. His separation by a few hours from that vertiginous red distance was no separation at all, and perhaps it never would be. At the moment he watched it, he knew his consciousness could have gone down into it, or—*out* into it. And now, this morning, he felt that he could still lose himself in it if he let go.

Plodding through the dim wood toward the trail, he came to the spot at which he had had his strange encounter. Here on the moss, there on the side of a shrub, yonder on the rocks where the furry body of a dead mouse lay twisted, were patches of blight. Some of it looked like the work of a blow-torch, some of it looked like a rust; but wherever it was, something was dead.

He stopped. Fellow was dead, that mouse was dead, that moss and those leaves were dead. A man could be dead, a culture could be dead. He tried to understand a civilization built on a metaphysical concept, and could not. He tried to understand how a civilization could die when that concept was negated, and could not. He knew, however, that these things could be whether he understood or not. He knew, because, for a moment, he had looked in a direction which he did not understand.

He closed his eyes and frowned. "Keep it simple," he muttered. Those other-men, those creatures—they *had* to find something different. "We will die first." What would that death be? And what would come after the death?

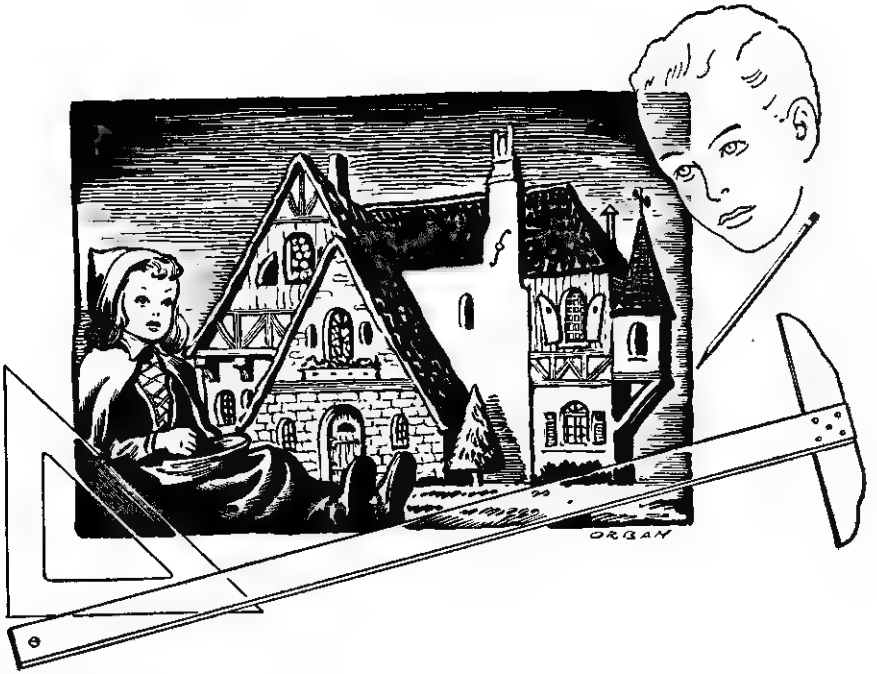
Life after death.

He laughed. They'd die and go to Heaven.

Then he remembered what Heaven was to these people, and he stopped laughing. It wasn't funny. He looked at the blight. It wasn't funny at all.

He sat down on a rock where he could see the dead mouse, put his chin in his hands, and wondered how, how in the name of Heaven, he could tell anyone.

THE END



IN HIDING

BY WILMAR H. SHIRAS

A new author presents a beautifully detailed discussion of the almost intolerable difficulties involved in a strange, and desperately urgent masquerade—that of a ten year-old boy pretending to be an ordinary ten-year-old boy.

Illustrated by Orban

Peter Welles, psychiatrist, eyed the boy thoughtfully. Why had Timothy Paul's teacher sent him for examination?

"I don't know, myself, that there's really anything wrong with Tim," Miss Page had told Dr. Welles. "He seems perfectly normal. He's rather quiet as a rule, doesn't volunteer answers in class or anything of that sort. He gets along well enough with other boys

and seems reasonably popular, although he has no special friends. His grades are satisfactory—he gets B faithfully in all his work. But when you've been teaching as long as I have, Peter, you get a feeling about certain ones. There is a tension about him—a look in his eyes sometimes—and he is very absent-minded."

"What would your guess be?" Welles had asked. Sometimes these hunches were very valuable. Miss Page had taught school for thirty-odd years; she had been Peter's teacher, in the past, and he thought highly of her opinion.

"I ought not to say," she answered. "There's nothing to go on—yet. But he might be starting something, and if it could be headed off—"

"Physicians are often called before the symptoms are sufficiently marked for the doctor to be able to see them," said Welles. "A patient, or the mother of a child, or any practiced observer, can often see that something is going to be wrong. But it's hard for the doctor in such cases. Tell me what you think I should look for."

"You won't pay too much attention to me? It's just what occurred to me, Peter; I know I'm not a trained psychiatrist. But it could be delusions of grandeur. Or it could be a withdrawing from the society of others. I always have to speak to him twice to get his attention in class—and he has no real chums."

Welles had agreed to see what he could find, and promised not to be too much influenced by what Miss Page herself called "an old woman's notions."

Timothy, when he presented himself for examination, seemed like an ordinary boy. He was perhaps a little small for his age, he had big dark eyes and close-cropped dark curls, thin sensitive fingers and—yes, a decided air of tension. But many boys were nervous on their first visit to the—psychiatrist. Peter often wished that he was able to concentrate on one or two schools, and spend a day a week or so getting acquainted with all the youngsters.

In response to Welles' preliminary questioning, Tim replied in a clear, low voice, politely and without wasting words. He was thirteen years old, and lived with his grandparents. His mother and father had died when he was a baby, and he did not remember them. He said that he was happy at home, that he liked school "pretty well," that he liked to play with other boys. He named several boys when asked who his friends were.

"What lessons do you like at school?"

Tim hesitated, then said: "English, and arithmetic . . . and history . . . and geography," he finished thoughtfully. Then he looked up, and there was something odd in the glance.

"What do you like to do for fun?"

"Read, and play games."

"What games?"

"Ball games . . . and marbles . . . and things like that. I like to play with other boys," he added, after a barely perceptible pause, "anything they play."

"Do they play at your house?"

"No; we play on the school grounds. My grandmother doesn't like noise."

Was that the reason? When a quiet boy offers explanations, they may not be the right ones.

"What do you like to read?"

But about his reading Timothy was vague. He liked, he said, to read "boys' books," but could not name any.

Welles gave the boy the usual intelligence tests. Tim seemed willing, but his replies were slow in coming. *Perhaps,* Welles thought, *I'm imagining this, but he is too careful—too cautious.* Without taking time to figure exactly, Welles knew what Tim's I.Q. would be—about 120.

"What do you do outside of school?" asked the psychiatrist.

"I play with the other boys. After supper, I study my lessons."

"What did you do yesterday?"

"We played ball on the school playground."

Welles waited a while to see whether Tim would say anything of his own accord. The seconds stretched into minutes.

"Is that all?" said the boy finally. "May I go now?"

"No; there's one more test I'd like to give you today. A game, really. How's your imagination?"

"I don't know."

"Cracks on the ceiling—like those over there—do they look like anything to you? Faces, animals, or anything?"

Tim looked.

"Sometimes. And clouds, too. Bob saw a cloud last week that was like a hippo." Again the last sentence sounded like something tacked on at the last moment, a careful addition made for a reason.

Welles got out the Rorschach cards. But at the sight of them, his patient's tension increased, his wariness became unmistakably evident. The first time they went through the cards, the boy could scarcely be persuaded to say anything but, "I don't know."

"You can do better than this," said Welles. "We're going through them again. If you don't see anything in these pictures, I have to mark you a failure," he explained. "That won't do. You did all right on the other things. And maybe next time we'll do a game you'll like better."

"I don't feel like playing this game now. Can't we do it again next time?"

"May as well get it done now. It's not only a game, you know, Tim; it's a test. Try harder, and be a good sport."

So Tim, this time, told what he saw in the ink blots. They went

through the cards slowly, and the test showed Tim's fear, and that there was something he was hiding; it showed his caution, a lack of trust, and an unnaturally high emotional self-control.

Miss Page had been right; the boy needed help.

"Now," said Welles cheerfully, "that's all over. We'll just run through them again quickly and I'll tell you what other people have seen in them."

A flash of genuine interest appeared on the boy's face for a moment.

Welles went through the cards slowly, seeing that Tim was attentive to every word. When he first said, "And some see what you saw here," the boy's relief was evident. Tim began to relax, and even to volunteer some remarks. When they had finished he ventured to ask a question.

"Dr. Welles, could you tell me the name of this test?"

"It's sometimes called the Rorschach test, after the man who worked it out."

"Would you mind spelling that?"

Welles spelled it, and added: "Sometimes it's called the ink-blot test."

Tim gave a start of surprise, and then relaxed again with a visible effort.

"What's the matter? You jumped."

"Nothing."

"Oh, come on! Let's have it," and Welles waited.

"Only that I thought about the ink-pool in the Kipling stories," said Tim, after a minute's reflection. "This is different."

"Yes, very different," laughed Welles. "I've never tried that. Would you like to?"

"Oh, no, sir," cried Tim earnestly.

"You're a little jumpy today," said Welles. "We've time for some more talk, if you are not too tired."

"No, I'm not very tired," said the boy warily.

Welles went to a drawer and chose a hypodermic needle. It wasn't usual, but perhaps— "I'll just give you a little shot to relax your nerves, shall I? Then we'd get on better."

When he turned around, the stark terror on the child's face stopped Welles in his tracks.

"Oh, no! Don't! Please, please, don't!"

Welles replaced the needle and shut the drawer before he said a word.

"I won't," he said, quietly. "I didn't know you didn't like shots. I won't give you any, Tim."

The boy, fighting for self-control, gulped and said nothing.

"It's all right," said Welles, lighting a cigarette and pretending to watch the smoke rise. Anything rather than appear to be watching the badly shaken small boy shivering in the chair opposite him. "Sorry. You didn't tell me about the things you don't like, the things you're afraid of."

The words hung in the silence.

"Yes," said Timothy slowly. "I'm afraid of shots. I hate needles. It's just one of those things." He tried to smile.

"We'll do without them, then. You've passed all the tests, Tim, and I'd like to walk home with you and tell your grandmother about it. Is that all right with you?"

"Yes, sir."

"We'll stop for something to eat," Welles went on, opening the door for his patient. "Ice cream, or a hot dog."

They went out together.

Timothy Paul's grandparents, Mr. and Mrs. Herbert Davis, lived in a large old-fashioned house that spelled money and position. The grounds were large, fenced, and bordered with shrubbery. Inside the house there was little that was new, everything was well-kept. Timothy led the psychiatrist to Mr. Davis's library, and then went in search of his grandmother.

When Welles saw Mrs. Davis, he thought he had some of the explanation. Some grandmothers are easy-going, jolly, comparatively young. This grandmother was, as it soon became apparent, quite different.

"Yes, Timothy is a pretty good boy," she said, smiling on her grandson. "We have always been strict with him, Dr. Welles, but I believe it pays. Even when he was a mere baby, we tried to teach him right ways. For example, when he was barely three I read him some little stories. And a few days later he was trying to tell us, if you will believe it, that he could read! Perhaps he was too young to know the nature of a lie, but I felt it my duty to make him understand. When he insisted, I spanked him. The child had a remarkable memory, and perhaps he thought that was all there was to reading. Well! I don't mean to brag of my brutality," said Mrs. Davis, with a charming smile. "I assure you, Dr. Welles, it was a painful experience for me. We've had very little occasion for punishments. Timothy is a good boy."

Welles murmured that he was sure of it.

"Timothy, you may deliver your papers now," said Mrs. Davis. "I am sure Dr. Welles will excuse you." And she settled herself for a good long talk about her grandson.

Timothy, it seemed, was the apple of her eye. He was a quiet boy, an obedient boy, and a bright boy.

"We have our rules, of course. I have never allowed Timothy to forget that children should be seen and not heard, as the good old-fashioned saying is. When he first learned to turn somersaults, when he was three or four years old, he kept coming to me and saying, 'Grandmother, see me!' I simply had to be firm with him. 'Timothy,' I said, 'let us have no more of this! It is simply showing off. If it amuses you to turn somersaults, well and good. But it doesn't amuse

me to watch you endlessly doing it. Play if you like, but do not demand admiration.' "

"Did you never play with him?"

"Certainly I played with him. And it was a pleasure to me also. We—Mr. Davis and I—taught him a great many games, and many kinds of handcraft. We read stories to him and taught him rhymes and songs. I took a special course in kindergarten craft, to amuse the child—and I must admit that it amused me also!" added Tim's grandmother, smiling reminiscently. "We made houses of toothpicks, with balls of clay at the corners. His grandfather took him for walks and drives. We no longer have a car, since my husband's sight has begun to fail him slightly, so now the garage is Timothy's workshop. We had windows cut in it, and a door, and nailed the large doors shut."

It soon became clear that Tim's life was not all strictures by any means. He had a workshop of his own, and upstairs beside his bedroom was his own library and study.

"He keeps his books and treasures there," said his grandmother, "his own little radio, and his schoolbooks, and his typewriter. When he was only seven years old, he asked us for a typewriter. But he is a careful child, Dr. Welles, not at all destructive, and I had read that in many schools they make use of typewriters in teaching young children to read and write and to spell. The words look the same as in printed books, you see; and less muscular effort is involved. So his grandfather got him a very nice noiseless typewriter, and he loved it dearly. I often hear it purring away as I pass through the hall. Timothy keeps his own rooms in good order, and his shop also. It is his own wish. You know how boys are—they do not wish others to meddle with their belongings. 'Very well, Timothy,' I told him, 'if a glance shows me that you can do it yourself properly, nobody will go into your rooms; but they must be kept neat.' And he has done so for several years. A very neat boy, Timothy."

"Timothy didn't mention his paper route," remarked Welles. "He said only that he plays with other boys after school."

"Oh, but he does," said Mrs. Davis. "He plays until five o'clock, and then he delivers his papers. If he is late, his grandfather walks down and calls him. The school is not very far from here, and Mr. Davis frequently walks down and watches the boys at their play. The paper route is Timothy's way of earning money to feed his cats. Do you care for cats, Dr. Welles?"

"Yes, I like cats very much," said the psychiatrist. "Many boys like dogs better."

"Timothy had a dog when he was a baby—a collie." Her eyes grew moist. "We all loved Ruff dearly. But I am no longer young, and the care and training of a dog is diffi-

cult. Timothy is at school or at the Boy Scout camp or something of the sort a great part of the time, and I thought it best that he should not have another dog. But you wanted to know about our cats, Dr. Welles. I raise Siamese cats."

"Interesting pets," said Welles cordially. "My aunt raised them at one time."

"Timothy is very fond of them. But three years ago he asked me if he could have a pair of black Persians. At first I thought not; but we like to please the child, and he promised to build their cages himself. He had taken a course in carpentry at vacation school. So he was allowed to have a pair of beautiful black Persians. But the very first litter turned out to be short-haired, and Timothy confessed that he had mated his queen to my Siamese tom, to see what would happen. Worse yet, he had mated his tom to one of my Siamese queens. I really was tempted to punish him. But, after all, I could see that he was curious as to the outcome of such cross-breeding. Of course I said the kittens must be destroyed. The second litter was exactly like the first—all black, with short hair. But you know what children are. Timothy begged me to let them live, and they were his first kittens. Three in one litter, two in the other. He might keep them, I said, if he would take full care of them and be responsible for all the expense. He mowed lawns and ran errands and made little footstools and bookcases to sell, and did all sorts of things, and probably used his allowance, too. But he kept the kittens and has a whole row of cages in the yard beside his workshop."

"And their offspring?" inquired Welles, who could not see what all this had to do with the main question, but was willing to listen to anything that might lead to information.

"Some of the kittens appear to be pure Persian, and others pure Siamese. These he insisted on keeping, although, as I have explained to him, it would be dishonest to sell them, since they are not pure-bred. A good many of the kittens are black short-haired and these we destroy. But enough of cats, Dr. Welles. And I am afraid I am talking too much about my grandson."

"I can understand that you are very proud of him," said Welles.

"I must confess that we are. And he is a bright boy. When he and his grandfather talk together, and with me also, he asks very intelligent questions. We do not encourage him to voice his opinions—I detest the smart-Aleck type of small boy—and yet I believe they would be quite good opinions for a child of his age."

"Has his health always been good?" asked Welles.

"On the whole, very good. I have taught him the value of exercise, play, wholesome food and suitable rest. He has had a few of the usual childish ailments, not seri-

ously. And he never has colds. But, of course, he takes his cold shots twice a year when we do."

"Does he mind the shots?" asked Welles, as casually as he could.

"Not at all. I always say that he, though so young, sets an example I find hard to follow. I still flinch, and really rather dread the ordeal."

Welles looked toward the door at a sudden, slight sound.

Timothy stood there, and he had heard. Again, fear was stamped on his face and terror looked out of his eyes.

"Timothy," said his grandmother, "don't stare."

"Sorry, sir," the boy managed to say.

"Are your papers all delivered? I did not realize we had been talking for an hour, Dr. Welles. Would you like to see Timothy's cats?" Mrs. Davis inquired graciously. "Timothy, take Dr. Welles to see your pets. We have had quite a talk about them."

Welles got Tim out of the room as fast as he could. The boy led the way around the house and into the side yard where the former garage stood.

There the man stopped.

"Tim," he said, "you don't have to show me the cats if you don't want to."

"Oh, that's all right."

"Is that part of what you are hiding? If it is, I don't want to see it until you are ready to show me."

Tim looked up at him then.

"Thanks," he said. "I don't mind about the cats. Not if you like cats really."

"I really do. But, Tim, this I would like to know: You're not afraid of the needle. Could you tell me why you were afraid . . . why you said you were afraid . . . of my shot? The one I promised not to give you after all?"

Their eyes met.

"You won't tell?" asked Tim.

"I won't tell."

"Because it was pentothal. Wasn't it?"

Welles gave himself a slight pinch. Yes, he was awake. Yes, this was a little boy asking him about pentothal. A boy who—Yes, certainly, a boy who knew about it.

"Yes, it was," said Welles. "A very small dose. You know what it is?"

"Yes, sir. I . . . I read about it somewhere. In the papers."

"Never mind that. You have a secret—something you want to hide. That's what you are afraid about, isn't it?"

The boy nodded dumbly.

"If it's anything wrong, or that might be wrong, perhaps I could help you. You'll want to know me better, first. You'll want to be sure you can trust me. But I'll be glad to help, any time you say the word, Tim. Or I might stumble on to things the way I did just now. One thing though—I never tell secrets."

"Never?"

"Never. Doctors and priests don't betray secrets. Doctors seldom, priests never. I guess I am more like a priest, because of the kind of doctoring I do."

He looked down at the boy's bowed head.

"Helping fellows who are scared sick," said the psychiatrist very gently. "Helping fellows in trouble, getting things straight again, fixing things up, unsnarling tangles. When I can, that's what I do. And I don't tell anything to anybody. It's just between that one fellow and me."

But, he added to himself, *I'll have to find out. I'll have to find out what ails this child. Miss Page is right—he needs me.*

They went to see the cats.

There were the Siamese in their cages, and the Persians in their cages, and there, in several small cages, the short-haired black cats and their hybrid offspring. "We take them into the house, or let them into this big cage, for exercise," explained Tim. "I take mine into my shop sometimes. These are all mine. Grandmother keeps hers on the sun porch."

"You'd never know these were not all pure-bred," observed Welles. "Which did you say were the full Persians? Any of their kittens here?"

"No; I sold them."

"I'd like to buy one. But these look just the same—it wouldn't make any difference to me. I want a pet, and wouldn't use it for breeding stock. Would you sell me one of these?"

Timothy shook his head.

"I'm sorry. I never sell any but the pure-breds."

It was then that Welles began to see what problem he faced. Very dimly he saw it, with joy, relief, hope and wild enthusiasm.

"Why not?" urged Welles. "I can wait for a pure-bred, if you'd

rather, but why not one of these? They look just the same. Perhaps they'd be more interesting."

Tim looked at Welles for a long, long minute.

"I'll show you," he said. "Promise to wait here? No, I'll let you come into the workroom. Wait a minute, please."

The boy drew a key from under his blouse, where it had hung suspended from a chain, and unlocked the door of his shop. He went inside, closed the door, and Welles could hear his moving about for a few moments. Then he came to the door and beckoned.

"Don't tell grandmother," said Tim. "I haven't told her yet. If it lives, I'll tell her next week."

In the corner of the shop under a table there was a box, and in the box there was a Siamese cat. When she saw a stranger she tried to hide her kittens; but Tim lifted her gently, and then Welles saw. Two of the kittens looked like little white rats with stringy tails and smudgy paws, ears and noses. But the third—yes, it was going to be a different sight. It was going to be a beautiful cat if it lived. It had long, silky white hair like the finest Persian, and the Siamese markings were showing up plainly.

Welles caught his breath.

"Congratulations, old man! Haven't you told anyone yet?"

"She's not ready to show. She's not a month old."

"But you're going to show her?"

"Oh, yes, Grandmother will be thrilled. She'll love her. Maybe there'll be more."

"You knew this would happen. You made it happen. You planned it all from the start," accused Welles.

"Yes," admitted the boy.

"How did you know?"

The boy turned away.

"I read it somewhere," said Tim.

The cat jumped back into the box and began to nurse her babies. Welles felt as if he could endure no more. Without a glance at anything else in the room—and everything else was hidden under tarpaulins and newspapers—he went to the door.

"Thanks for showing me, Tim," he said. "And when you have any to sell, remember me. I'll wait. I want one like that."

The boy followed him out and locked the door carefully.

"But Tim," said the psychiatrist, "that's not what you were afraid I'd find out. I wouldn't need a drug to get you to tell me this, would I?"

Tim replied carefully, "I didn't want to tell this until I was ready. Grandmother really ought to know first. But you made me tell you."

"Tim," said Peter Welles earnestly, "I'll see you again. Whatever you are afraid of, don't be afraid of me. I often guess secrets. I'm on the way to guessing yours already. But nobody else need ever know."

He walked rapidly home, whistling to himself from time to time.

Perhaps he, Peter Welles, was the luckiest man in the world.

He had scarcely begun to talk to Timothy on the boy's next appearance at the office, when the phone in the hall rang. On his return, when he opened the door he saw a book in Tim's hands. The boy made a move as if to hide it, and thought better of it.

Welles took the book and looked at it.

"Want to know more about Rorschach, eh?" he asked.

"I saw it on the shelf. I—"

"Oh, that's all right," said Welles, who had purposely left the book near the chair Tim would occupy. "But what's the matter with the library?"

"They've got some books about it, but they're on the closed shelves. I couldn't get them." Tim spoke without thinking first, and then caught his breath.

But Welles replied calmly: "I'll get it out for you. I'll have it next time you come. Take this one along today when you go. Tim, I mean it—you can trust me."

"I can't tell you anything," said the boy. "You've found out some things. I wish . . . oh, I don't know what I wish! But I'd rather be let alone. I don't need help. Maybe I never will. If I do, can't I come to you then?"

Welles pulled out his chair and sat down slowly.

"Perhaps that would be the best way, Tim. But why wait for the ax to fall? I might be able to help you ward it off—what you're afraid of. You can kid people along about the cats; tell them you were fooling around to see what would happen. But you can't fool all of the people all of the time, they tell me. Maybe with me to help, you could. Or with me to back you up, the blowup would be easier. Easier on your grandparents, too."

"I haven't done anything wrong!"

"I'm beginning to be sure of that. But things you try to keep hidden may come to light. The kitten—you could hide it, but you don't want to. You've got to risk something to show it."

"I'll tell them I read it somewhere."

"That wasn't true, then. I thought not. You figured it out."

There was silence.

Then Timothy Paul said: "Yes. I figured it out. But that's my secret."

"It's safe with me."

But the boy did not trust him yet. Welles soon learned that he had been tested. Tim took the book home, and returned it, took the library books which Welles got for him, and in due course returned them also. But he talked little and was still wary. Welles could talk all he liked, but he got little or nothing out of Tim. Tim had told all he was going to tell. He would talk about nothing except what any boy would talk about.

After two months of this, during which Welles saw Tim officially once a week and unofficially several times—showing up at the school playground to watch games, or meeting Tim on the paper route and treating him to a soda after it was finished—Welles had learned very little more. He tried again. He had probed no more during the two months, respected the boy's silence, trying to give him time to get to know and trust him.

But one day he asked: "What are you going to do when you grow up, Tim? Breed cats?"

Tim laughed a denial.

"I don't know what, yet. Sometimes I think one thing, sometimes another."

This was a typical boy answer. Welles disregarded it.

"What would you like to do best of all?" he asked.

Tim leaned forward eagerly. "What you do!" he cried.

"You've been reading up on it, I suppose," said Welles, as casually as he could. "Then you know, perhaps, that before anyone can do what I do, he must go through it himself, like a patient. He must also study medicine and be a full-fledged doctor, of course. You can't do that yet. But you can have the works now, like a patient."

"Why? For the experience?"

"Yes. And for the cure. You'll have to face that fear and lick it. You'll have to straighten out a lot of other things, or at least face them."

"My fear will be gone when I'm grown up," said Timothy. "I think it will. I hope it will."

"Can you be sure?"

"No," admitted the boy. "I don't know exactly why I'm afraid. I just know I *must* hide things. Is that bad, too?"

"Dangerous, perhaps."

Timothy thought a while in silence. Welles smoked three cigarettes and yearned to pace the floor, but dared not move.

"What would it be like?" asked Tim finally.

"You'd tell me about yourself. What you remember. Your childhood—the way your grandmother runs on when she talks about you."

"She sent me out of the room. I'm not supposed to think I'm bright," said Tim, with one of his rare grins.

"And you're not supposed to know how well she reared you?"

"She did fine," said Tim. "She taught me all the wisest things I ever knew."

"Such as what?"

"Such as shutting up. Not telling all you know. Not showing off."

"I see what you mean," said Welles. "Have you heard the story of St. Thomas Aquinas?"

"No."

"When he was a student in Paris, he never spoke out in class, and the others thought him stupid. One of them kindly offered to help him, and went over all the work very patiently to make him understand it.

And then one day they came to a place where the other student got all mixed up and had to admit he didn't understand. Then Thomas suggested a solution and it was the right one. He knew more than any of the others all the time; but they called him the Dumb Ox."

Tim nodded gravely.

"And when he grew up?" asked the boy.

"He was the greatest thinker of all time," said Welles. "A fourteenth-century super-brain. He did more original work than any other ten great men; and he died young."

After that, it was easier.

"How do I begin?" asked Timothy.

"You'd better begin at the beginning. Tell me all you can remember about your early childhood, before you went to school."

Tim gave this his consideration.

"I'll have to go forward and backward a lot," he said. "I couldn't put it all in order."

"That's all right. Just tell me today all you can remember about that time of your life. By next week you'll have remembered more. As we go on to later periods of your life, you may remember things that belonged to an earlier time; tell them then. We'll make some sort of order out of it."

Welles listened to the boy's revelations with growing excitement. He found it difficult to keep outwardly calm.

"When did you begin to read?" Welles asked.

"I don't know when it was. My grandmother read me some stories, and somehow I got the idea about the words. But when I tried to tell her I could read, she spanked me. She kept saying I couldn't, and I kept saying I could, until she spanked me. For a while I had a dreadful time, because I didn't know any word she hadn't read to me—I guess I sat beside her and watched, or else I remembered and then went over it by myself right after. I must have learned as soon as I got the idea that each group of letters on the page was a word."

"The word-unit method," Welles commented. "Most self-taught readers learned like that."

"Yes. I have read about it since. And Macaulay could read when he was three, but only upside-down, because of standing opposite when his father read the Bible to the family."

"There are many cases of children who learned to read as you did, and surprised their parents. Well? How did you get on?"

"One day I noticed that two words looked almost alike and sounded almost alike. They were 'can' and 'man.' I remember staring at them and then it was like something beautiful boiling up in me. I began to look carefully at the words, but in a crazy excitement. I was a long while at it, because when I put down the book and tried to stand up I was stiff all over. But

I had the idea, and after that it wasn't hard to figure out almost any words. The really hard words are the common ones that you get all the time in easy books. Other words are pronounced the way they are spelled."

"And nobody knew you could read?"

"No. Grandmother told me not to say I could, so I didn't. She read to me often, and that helped. We had a great many books, of course, I liked those with pictures. Once or twice they caught me with a book that had no pictures, and then they'd take it away and say, 'I'll find a book for a little boy.'"

"Do you remember what books you liked then?"

"Books about animals, I remember. And geographies. It was funny about animals—"

Once you got Timothy started, thought Welles, it wasn't hard to get him to go on talking.

"One day I was at the Zoo," said Tim, "and by the cages alone. Grandmother was resting on a bench and she let me walk along by myself. People were talking about the animals and I began to tell them all I knew. It must have been funny in a way, because I had read a lot of words I couldn't pronounce correctly, words I had never heard spoken. They listened and asked me questions and I thought I was just like grandfather, teaching them the way he sometimes taught me. And then they called another man to come, and said, 'Listen to this kid; he's a scream!' and I saw they were all laughing at me."

Timothy's face was redder than usual, but he tried to smile as he added, "I can see now how it must have sounded funny. And unexpected, too; that's a big point in humor. But my little feelings were so dreadfully hurt that I ran back to my grandmother crying, and she couldn't find out why. But it served me right for disobeying her. She always told me not to tell people things; she said a child had nothing to teach its elders."

"Not in that way, perhaps—at that age."

"But, honestly, some grown people don't know very much," said Tim. "When we went on the train last year, a woman came up and sat beside me and started to tell me things a little boy should know about California. I told her I'd lived here all my life, but I guess she didn't even know we are taught things in school, and she tried to tell me things, and almost everything was wrong."

"Such as what?" asked Welles, who had also suffered from tourists.

"We . . . she said so many things . . . but I thought this was the funniest: She said all the Missions were so old and interesting, and I said yes, and she said, 'You know, they were all built long before Columbus discovered America,' and I thought she meant it for a joke, so I laughed. She looked very serious and said, 'Yes, those people all came up here from Mexico.' I

suppose she thought they were Aztec temples."

Welles, shaking with laughter, could not but agree that many adults were sadly lacking in the rudiments of knowledge.

"After that Zoo experience, and a few others like it, I began to get wise to myself," continued Tim. "People who knew things didn't want to hear me repeating them, and people who didn't know, wouldn't be taught by a four-year-old baby. I guess I was four when I began to write."

"How?"

"Oh, I just thought if I couldn't say anything to anybody at any time, I'd burst. So I began to put it down—in printing, like in books. Then I found out about writing, and we had some old-fashioned school-books that taught how to write. I'm left-handed. When I went to school, I had to use my right hand. But by then I had learned how to pretend that I didn't know things. I watched the others and did as they did. My grandmother told me to do that."

"I wonder why she said that," marveled Welles.

"She knew I wasn't used to other children, she said, and it was the first time she had left me to anyone else's care. So she told me to do what the others did and what my teacher said," explained Tim simply, "and I followed her advice literally. I pretended I didn't know anything, until the others began to know it, too. Lucky I was so shy. But there were things to learn, all right. Do you know, when I first went to school, I was disappointed because the teacher dressed like other women. The only picture of teachers I had noticed were those in an old Mother Goose book, and I thought that all teachers wore hoop skirts. But as soon as I saw her, after the little shock of surprise, I knew it was silly, and I never told."

The psychiatrist and the boy laughed together.

"We played games. I had to learn to play with children, and not be surprised when they slapped or pushed me. I just couldn't figure out why they'd do that, or what good it did them. But if it was to surprise me, I'd say 'Boo' and surprise them some time later; and if they were mad because I had taken a ball or something they wanted, I'd play with them."

"Anybody ever try to beat you up?"

"Oh, yes. But I had a book about boxing—with pictures. You can't learn much from pictures, but I got some practice too, and that helped. I didn't want to win, anyway. That's what I like about games of strength or skill—I'm fairly matched, and I don't have to be always watching in case I might show off or try to boss somebody around."

"You must have tried bossing sometimes."

"In books, they all cluster around the boy who can teach new games

and think up new things to play. But I found out that doesn't work. They just want to do the same thing all the time—like hide and seek. It's no fun if the first one to be caught is 'it' next time. The rest just walk in any old way and don't try to hide or even to run, because it doesn't matter whether they are caught. But you can't get the boys to see that, and play right, so the last one caught is 'it.' "

Timothy looked at his watch.

"Time to go," he said. "I've enjoyed talking to you, Dr. Welles. I hope I haven't bored you too much."

Welles recognized the echo and smiled appreciatively at the small boy.

"You didn't tell me about the writing. Did you start to keep a diary?"

"No. It was a newspaper. One page a day, no more and no less. I still keep it," confided Tim. "But I get more on the page now. I type it."

"And you write with either hand now?"

"My left hand is my own secret writing. For school and things like that I use my right hand."

When Timothy had left, Welles congratulated himself. But for the next month he got no more. Tim would not reveal a single significant fact. He talked about ball-playing, he described his grandmother's astonished delight over the beautiful kitten, he told of its growth and the tricks it played. He gravely related such enthralling facts as that he liked to ride on trains, that his favorite wild animal was the lion, and that he greatly desired to see snow falling. But not a word of what Welles wanted to hear. The psychiatrist, knowing that he was again being tested, waited patiently.

Then one afternoon when Welles, fortunately unoccupied with a patient, was smoking a pipe on his front porch, Timothy Paul strode into the yard.

"Yesterday Miss Page asked me if I was seeing you and I said yes. She said she hoped my grandparents didn't find it too expensive, because you had told her I was all right and didn't need to have her worrying about me. And then I said to grandma, was it expensive for you to talk to me, and she said, 'Oh no, dear; the school pays for that. It was your teacher's idea that you have a few talks with Dr. Welles.' "

"I'm glad you came to me, Tim, and I'm sure you didn't give me away to either of them. Nobody's paying me. The school pays for my services if a child is in a bad way and his parents are poor. It's a new service, since 1956. Many maladjusted children can be helped —much more cheaply to the state than the cost of having them go crazy or become criminals or something. You understand all that. But —sit down, Tim!—I can't charge the state for you, and I can't charge your grandparents. You're ad-

justed marvelously well in every way, as far as I can see; and when I see the rest, I'll be even more sure of it."

"Well—gosh! I wouldn't have come—" Tim was stammering in confusion. "You ought to be paid. I take up so much of your time. Maybe I'd better not come any more."

"I think you'd better. Don't you?"

"Why are you doing it for nothing, Dr. Welles?"

"I think you know why."

The boy sat down in the glider and pushed himself meditatively back and forth. The glider squeaked.

"You're interested. You're curious," he said.

"That's not all, Tim."

Squeak-squeak. Squeak-squeak.

"I know," said Timothy. "I believe it. Look, is it all right if I call you Peter? Since we're friends."

At their next meeting, Timothy went into details about his newspaper. He had kept all the copies, from the first smudged, awkwardly printed pencil issues to the very latest neatly typed ones. But he would not show Welles any of them.

"I just put down every day the things I most wanted to say, the news or information or opinion I had to swallow unsaid. So it's a wild medley. The earlier copies are awfully funny. Sometimes I guess what they were all about, what made me write them. Sometimes I remember. I put down the books I read too, and mark them like school grades, on two points—how I liked the book, and whether it was good. And whether I had read it before, too."

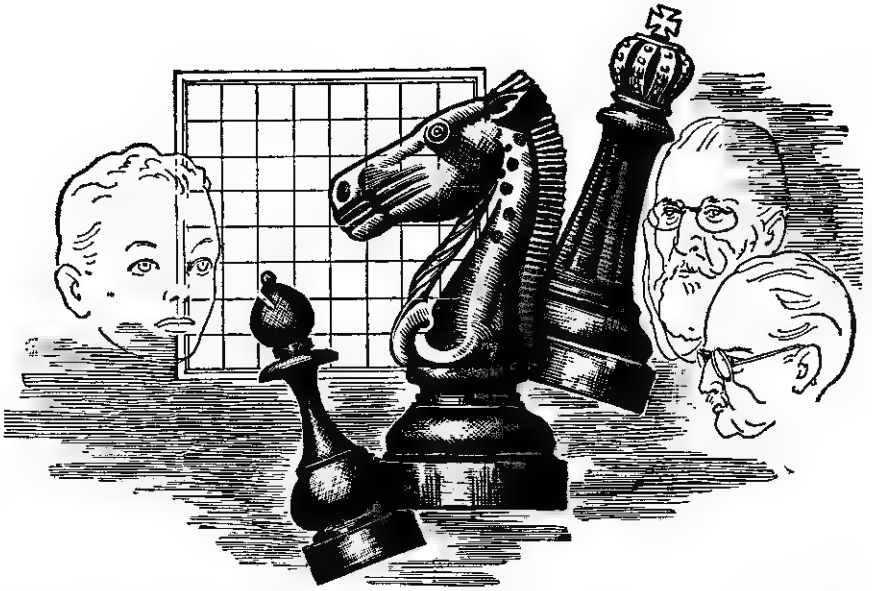
"How many books do you read? What's your reading speed?"

It proved that Timothy's reading speed on new books of adult level varied from eight hundred to nine hundred fifty words a minute. The average murder mystery—he loved them—took him less than half an hour. A year's homework in history, Tim performed easily by reading his textbook through three or four times during the year. He apologized for that, but explained that he had to know what was in the book so as not to reveal in examinations too much that he had learned from other sources. Evenings, when his grandparents believed him to be doing homework, he spent reading other books, or writing his newspaper, "or something." As Welles had already guessed, Tim had read everything in his grandfather's library, everything in the public library that was not on the closed shelves, and everything he could order from the state library.

"What do the librarians say?"

"They think the books are for my grandfather. I tell them that, if they ask what a little boy wants with such a big book. Peter, telling so many lies is what gets me down. I have to do it, don't I?"

"As far as I can see, you do,"



agreed Welles. "But here's material for a while in my library. There'll have to be a closed shelf here, too, though, Tim."

"Could you tell me why? I know about the library books. Some of them might scare people, and some are—"

"Some of my books might scare you too, Tim. I'll tell you a little about abnormal psychology if you like, one of these days, and then I think you'll see that until you're actually training to deal with such cases, you'd be better off not knowing too much about them."

"I don't want to be morbid," agreed Tim. "All right. I'll read only what you give me. And from now on I'll tell you things. There was more than the newspaper, you know."

"I thought as much. Do you want to go on with your tale?"

"It started when I first wrote a letter to a newspaper—of course, under a pen name. They printed it. For a while I had a high old time of it—a letter almost every day, using all sorts of pen names. Then I branched out to magazines, letters to the editor again. And stories—I tried stories."

He looked a little doubtfully at Welles, who said only: "How old were you when you sold the first story?"

"Eight," said Timothy. "And when the check came, with my name on it, 'T. Paul,' I didn't know what in the world to do."

"That's a thought. What did you do?"

"There was a sign in the window

of the bank. I always read signs, and that one came back to my mind. 'Banking By Mail.' You can see I was pretty desperate. So I got the name of a bank across the Bay and I wrote them—on my typewriter—and said I wanted to start an account, and here was a check to start it with. Oh, I was scared stiff, and had to keep saying to myself that, after all, nobody could do much to me. It was my own money. But you don't know what it's like to be only a small boy! They sent the check back to me and I died ten deaths when I saw it. But the letter explained. I hadn't endorsed it. They sent me a blank to fill out about myself. I didn't know how many lies I dared to tell. But it was my money and I had to get it. If I could get it into the bank, then some day I could get it out. I gave my business as 'author' and I gave my age as twenty-four. I thought that was awfully old."

"I'd like to see the story. Do you have a copy of the magazine around?"

"Yes," said Tim. "But nobody noticed it—I mean, 'T. Paul' could be anybody. And when I saw magazines for writers on the newsstands, and bought them I got on to the way to use a pen name on the story and my own name and address up in the corner. Before that I used a pen name and sometimes never got the things back or heard about them. Sometimes I did, though."

"What then?"

"Oh, then I'd endorse the check payable to me and sign the pen name, and then sign my own name under it. Was I scared to do that! But it was my money."

"Only stories?"

"Articles, too. And things. That's enough of that for today. Only—I just wanted to say—a while ago, T. Paul told the bank he wanted to switch some of the money over to a checking account. To buy books by mail, and such. So, I could pay you, Dr. Welles—" with sudden formality.

"No, Tim," said Peter Welles firmly. "The pleasure is all mine. What I want is to see the story that was published when you were eight. And some of the other things that made T. Paul rich enough to keep a consulting psychiatrist on the payroll. And, for the love of Pete, will you tell me how all this goes on without your grandparents' knowing a thing about it?"

"Grandmother thinks I send in box tops and fill out coupons," said Tim. "She doesn't bring in the mail. She says her little boy gets such a big bang out of that little chore. Anyway that's what she said when I was eight. I played mailman. And there were box tops—I showed them to her, until she said, about the third time, that really she wasn't greatly interested in such matters. By now she has the habit of waiting for me to bring in the mail."

Peter Welles thought that was quite a day of revelation. He spent a quiet evening at home, holding his

head and groaning, trying to take it all in.

And that I. Q.—120, nonsense! The boy had been holding out on him. Tim's reading had obviously included enough about I. Q. tests, enough puzzles and oddments in magazines and such, to enable him to stall successfully. What could he do if he would co-operate?

Welles made up his mind to find out.

He didn't find out. Timothy Paul went swiftly through the whole range of Superior Adult tests without a failure of any sort. There were no tests yet devised that could measure his intelligence. While he was still writing his age with one figure, Timothy Paul had faced alone, and solved alone, problems that would have baffled the average adult. He had adjusted to the hardest task of all—that of appearing to be a fairly normal, B-average small boy.

And it must be that there was more to find out about him. What did he write? And what did he do besides read and write, learn carpentry and breed cats and magnificently fool his whole world?

When Peter Welles had read some of Tim's writings, he was surprised to find that the stories the boy had written were vividly human, the product of close observation of human nature. The articles, on the other hand, were closely reasoned and showed thorough study and research. Apparently Tim read every word of several newspapers and a score or more of periodicals.

"Oh, sure," said Tim, when questioned. "I read everything. I go back once in a while and review old ones, too."

"If you can write like this," demanded Welles, indicating a magazine in which a staid and scholarly article had appeared, "and this"—this was a man-to-man political article giving the arguments for and against a change in the whole Congressional system—"then why do you always talk to me in the language of an ordinary stupid schoolboy?"

"Because I'm only a little boy," replied Timothy. "What would happen if I went around talking like that?"

"You might risk it with me. You've showed me these things."

"I'd never dare to risk talking like that. I might forget and do it again before others. Besides, I can't pronounce half the words."

"What!"

"I never look up a pronunciation," explained Timothy. "In case I do slip and use a word beyond the average, I can anyway hope I didn't say it right."

Welles shouted with laughter, but was sober again as he realized the implications back of that thoughtfulness.

"You're just like an explorer living among savages," said the psychiatrist. "You have studied the savages carefully and tried to imi-

tate them so they won't know there are differences."

"Something like that," acknowledged Tim.

"That's why your stories are so human," said Welles. "That one about the awful little girl—"

They both chuckled.

"Yes, that was my first story," said Tim. "I was almost eight, and there was a boy in my class who had a brother, and the boy next door was the other one, the one who was picked on."

"How much of the story was true?"

"The first part. I used to see, when I went over there, how that girl picked on Bill's brother's friend Steve. She wanted to play with Steve all the time herself and whenever he had boys over, she'd do something awful. And Steve's folks were just like I said—they wouldn't let Steve do anything to a girl. When she threw all the watermelon rinds over the fence into his yard, he just had to pick them all up and say nothing back; and she'd laugh at him over the fence. She got him blamed for things he never did, and when he had work to do in the yard she'd hang out of her window and scream at him and make fun. I thought first, what made her act like that, and then I made up a way for him to get even with her, and wrote it out the way it might have happened."

"Didn't you pass the idea on to Steve and let him try it?"

"Gosh, no! I was only a little boy. Kids seven don't give ideas to kids ten. That's the first thing I had to learn—to be always the one that kept quiet, especially if there was any older boy or girl around, even only a year or two older. I had to learn to look blank and let my mouth hang open and say, 'I don't get it,' to almost everything."

"And Miss Page thought it was odd that you had no close friends of your own age," said Welles. "You must be the loneliest boy that ever walked this earth, Tim. You've lived in hiding like a criminal. But tell me, what are you afraid of?"

"I'm afraid of being found out, of course. The only way I can live in this world is in disguise—until I'm grown up, at any rate. At first, it was just my grandparents scolding me and telling me not to show off, and the way people laughed if I tried to talk to them. Then I saw how people hate anyone who is better or brighter or luckier. Some people sort of trade off; if you're bad at one thing you're good at another, but they'll forgive you for being good at some things, because you're not good at others and they can balance that off. They can beat you at something. You have to strike a balance. A child has no chance at all. No grownup can stand it to have a child know anything he doesn't. Oh, a little thing, if it amuses them. But not much of anything. There's an old story about a man who found himself in a country where everyone else was blind. I'm like that—but they shan't put

out my eyes. I'll never let them know I can see anything."

"Do you see things that no grown person can see?"

Tim waved his hand towards the magazines.

"Only like that, I meant. I hear people talking, in street cars and stores, and while they work, and around. I read about the way they act in the news. I'm like them, just like them, only I seem about a hundred years older—more matured."

"Do you mean that none of them have much sense?"

"I don't mean that exactly. I mean that so few of them have any, or show it if they do have. They don't even seem to want to. They're good people in their way, but what could they make of me? Even when I was seven, I could understand their motives, but they couldn't understand their own motives. And they're so lazy—they don't seem to want to know or to understand. When I first went to the library for books, the books I learned from were seldom touched by any of the grown people. But they were meant for ordinary grown people. But the grown people didn't want to know things—they only wanted to fool around. I feel about most people the way my grandmother feels about babies and puppies. Only she doesn't have to pretend to be a puppy all the time," Tim added, with a little bitterness.

"You have a friend now, in me."

"Yes, Peter," said Tim, brightening up. "And I have pen friends, too. People like what I write, because they can't see I'm only a little boy. When I grow up—"

Tim did not finish that sentence. Welles understood, now, some of the fears that Tim had not dared to put into words at all. When he grew up, would he be as far beyond all other grownups as he had, all his life, been above his contemporaries? The adult friends whom he now met on fairly equal terms—would they then, too, seem like babies or puppies?

Peter did not dare to voice the thought, either. Still less did he venture to hint at another thought. Tim, so far, had no great interest in girls; they existed for him as part of the human race, but there would come a time when Tim would be a grown man and would wish to marry. And where among the puppies could he find a mate?

"When you're grown up, we'll still be friends," said Peter. "And who are the others?"

It turned out that Tim had pen friends all over the world. He played chess by correspondence—a game he never dared to play in person, except when he forced himself to move the pieces about idly and let his opponent win at least half the time. He had, also, many friends who had read something he had written, and had written to him about it, thus starting a correspondence-friendship. After the first two or three of these, he had started

some on his own account, always with people who lived at a great distance. To most of these he gave a name which, although not false, looked it. That was Paul T. Lawrence. Lawrence was his middle name; and with a comma after the Paul, it was actually his own name. He had a post office box under that name, for which T. Paul of the large bank account was his reference.

"Pen friends abroad? Do you know languages?"

Yes, Tim did. He had studied by correspondence, also; many universities gave extension courses in that manner, and lent the student records to play so that he could learn the correct pronunciation. Tim had taken several such courses, and learned other languages from books. He kept all these languages in practice by means of the letters to other lands and the replies which came to him.

"I'd buy a dictionary, and then I'd write to the mayors of some towns, or to a foreign newspaper, and ask them to advertise for some pen friends to help me learn the language. We'd exchange souvenirs and things."

Nor was Welles in the least surprised to find that Timothy had also taken other courses by correspondence. He had completed, within three years, more than half the subjects offered by four separate universities, and several other courses, the most recent being Architecture. The boy, not yet fourteen, had completed a full course in that subject and, had he been able to disguise himself as a full-grown man, could have gone out at once and built almost anything you'd like to name, for he also knew much of the trades involved.

"It always said how long an average student took, and I'd take that long," said Tim, "so, of course, I had to be working several schools at the same time."

"And carpentry at the playground summer school?"

"Oh, yes. But there I couldn't do too much, because people could see me. But I learned how, and it made a good cover-up, so I could make cages for the cats, and all that sort of thing. And many boys are good with their hands. I like to work with my hands. I built my own radio too—it gets all the foreign stations, and that helps me with my languages."

"How did you figure it about the cats?" asked Welles.

"Oh, there had to be recessives, that's all. The Siamese coloring was a recessive, and it had to be mated with another recessive. Black was one possibility, and white was another, but I started with black because I liked it better. I might try white too, but I have so much else on my mind—"

He broke off suddenly and would say no more.

Their next meeting was by prearrangement at Tim's workshop. Welles met the boy after school and

they walked to Tim's home together; there the boy unlocked his door and snapped on the lights.

Welles looked around with interest. There was a bench, a tool chest. Cabinets, padlocked. A radio, clearly not store-purchased. A file cabinet, locked. Something on a table, covered with a cloth. A box in the corner—no, two boxes in two corners. In each of them was a mother cat with kittens. Both mothers were black Persians.

"This one must be all black Persian," Tim explained. "Her third litter and never a Siamese marking. But this one carries both recessives in her. Last time she had a Siamese short-haired kitten. This morning—I had to go to school. Let's see."

They bent over the box where the new-born kittens lay. One kitten was like the mother. The other two were Siamese-Persian; a male and a female.

"You've done it again, Tim!" shouted Welles. "Congratulations!"

They shook hands in jubilation.

"I'll write it in the record," said the boy blissfully.

In a nickel book marked "Compositions" Tim's left hand added the entries. He had used the correct symbols—F_1, F_2, F_3; Ss, Bl.

"The dominants in capitals," he explained, "B for black, and S for short hair; the recessives in small letters—s for Siamese, l for long hair. Wonderful to write ll over ss again, Peter! Twice more. And the other kitten is carrying the Siamese markings as a recessive."

He closed the book in triumph.

"Now," and he marched to the covered thing on the table, "my latest big secret."

Tim lifted the cloth carefully and displayed a beautifully built doll house. No, a model house—Welles corrected himself swiftly. A beautiful model, and—yes, built to scale.

"The roof comes off. See, it has a big storage room and a room for a play room or a maid or something. Then I lift off the attic—"

"Good heavens!" cried Peter Welles. "Any little girl would give her soul for this!"

"I used fancy wrapping papers for the wallpapers. I wove the rugs on a little hand loom," gloated Timothy. "The furniture's just like real, isn't it? Some I bought; that plastic. Some I made of construction paper and things. The curtains were the hardest; but I couldn't ask grandmother to sew them—"

"Why not?" the amazed doctor managed to ask.

"She might recognize this afterwards," said Tim, and he lifted off the upstairs floor.

"Recognize it? You haven't showed it to her? Then when would she see it?"

"She might not," admitted Tim. "But I have to take some risks."

"That's a very livable floor plan you've used," said Welles, bending closer to examine the house in detail.

"Yes, I thought so. It's awful how many house plans leave no clear wall space for books or pic-

tures. Some of them have doors placed so you have to detour around the dining room table every time you go from the living room to the kitchen, or o that a whole corner of a room is good for nothing, with doors at all angles. Now, I designed this house to—"

"You designed it, Tim!"

"Why, sure. Oh, I see—you thought I built it from blueprints I'd bought. My first model home, I did, but the architecture courses gave me so many ideas that I wanted to see how they would look. Now, the cellar and game room—"

Welles came to himself an hour later, and gasped when he looked at his watch.

"It's too late. My patient has gone home again by this time. I may as well stay—how about the paper route?"

"I gave that up. Grandmother offered to feed the cats as soon as I gave her the kitten. And I wanted the time for this. Here are the pictures of the house."

The color prints were very good.

"I'm sending them and an article to the magazines," said Tim. "This time I'm T. L. Paul. Sometimes I used to pretend all the different people I am were talking together—but now I talk to you instead, Peter."

"Will it bother the cats if I smoke? Thanks. Nothing I'm likely to set on fire, I hope? Put the house together and let me sit here and look at it. I want to look in through the windows. Put its little lights on. There."

The young architect beamed, and snapped on the little lights.

"Nobody can see in here. I got Venetian blinds; and when I work in here, I even shut them sometimes."

"If I'm to know all about you, I'll have to go through the alphabet from A to Z," said Peter Welles. "This is Architecture. What else in the A's?"

"Astronomy. I showed you those articles. My calculations proved correct. Astrophysics—I got A in the course, but haven't done anything original so far. Art, no, I can't paint or draw very well, except mechanical drawing. I've done all the Merit Badge work in scouting, all through the alphabet."

"Darned if I can see you as a Boy Scout," protested Welles.

"I'm a very good Scout. I have almost as many badges as any other boy my age in the troop. And at camp I do as well as most city boys."

"Do you do a good turn every day?"

"Yes," said Timothy. "Started that when I first read about Scouting—I was a Scout at heart before I was old enough to be a Cub. You know, Peter, when you're very young you take all that seriously, about the good deed every day, and the good habits and ideals and all that. And then you get older and it begins to seem funny and childish and posed and artificial, and you smile in a stiperior way and make

jokes. But there is a third step, too, when you take it all seriously again. People who make fun of the Scout Law are doing the boys a lot of harm; but those who believe in things like that don't know how to say so, without sounding priggish and platitudinous. I'm going to do an article on it before long."

"Is the Scout Law your religion—if I may put it that way?"

"No," said Timothy. "But 'a Scout is Reverent.' Once I tried to study the churches and find out what was the truth. I wrote letters to pastors of all denominations—all those in the phone book and the newspaper—when I was on a vacation in the East, I got the names, and then wrote after I got back. I couldn't write to people here in the city. I said I wanted to know which church was true, and expected them to write to me and tell me about theirs, and argue with me, you know. I could read library books, and all they had to do was recommend some, I told them, and then correspond with me a little about them."

"Did they?"

"Some of them answered," said Tim, "but nearly all of them told me to go to somebody near me. Several said they were very busy men. Some gave me the name of a few books, but none of them told me to write again, and . . . and I was only a little boy. Nine years old, so I couldn't talk to anybody. When I thought it over, I knew that I couldn't very well join any church so young, unless it was my grandparents' church. I keep on going there—it is a good church and it teaches a great deal of truth, I am sure. I'm reading all I can find, so when I am old enough I'll know what I must do. How old would you say I should be, Peter?"

"College age," replied Welles. "You are going to college? By then, any of the pastors would talk to you—except those that are too busy!"

"It's a moral problem, really. Have I the right to wait? But I have to wait. It's like telling lies—I have to tell some lies, but I hate to. If I have a moral obligation to join the true church as soon as I find it, well, what then? I can't, until I'm eighteen or twenty?"

"If you can't, you can't. I should think that settles it. You are legally a minor, under the control of your grandparents, and while you might claim the right to go where your conscience leads you, it would be impossible to justify and explain your choice without giving yourself away entirely—just as you are obliged to go to school until you are at least eighteen, even though you know more than most Ph.D.'s. It's all part of the game, and He who made you must understand that."

"I'll never tell you any lies," said Tim. "I was getting so desperately lonely—my pen pals didn't know anything about me really. I told them only what was right for them to know. Little kids are satisfied

to be with other people but when you get a little older you have to make friends, really."

"Yes, that's a part of growing up. You have to reach out to others and share thoughts with them. You've kept to yourself too long as it is."

"It wasn't that I wanted to. But without a real friend, it was only pretense, and I never could let my playmates know anything about me. I studied them and wrote stories about them and it was all of them, but it was only a tiny part of me."

"I'm proud to be your friend, Tim. Every man needs a friend. I'm proud that you trust me."

Tim patted the cat a moment in silence and then looked up with a grin.

"How would you like to hear my favorite joke?" he asked.

"Very much," said the psychiatrist, bracing himself for almost any major shock.

"It's records. I recorded this from a radio program."

Welles listened. He knew little of music, but the symphony which he heard pleased him. The announcer praised it highly in little speeches before and after each movement. Timothy giggled.

"Like it?"

"Very much. I don't see the joke."

"I wrote it."

"Tim, you're beyond me! But I still don't get the joke."

"The joke is that I did it by mathematics. I calculated what ought to sound like joy, grief, hope, triumph, and all the rest, and—it was just after I had studied harmony; you know how mathematical that is."

Speechless, Welles nodded.

"I worked out the rhythms from different metabolisms—the way you function when under the influences of these emotions; the way your metabolic rate varies, your heartbeats and respiration and things. I sent it to the director of that orchestra, and he didn't get the idea that it was a joke—of course I didn't explain—he produced the music. I get nice royalties from it, too."

"You'll be the death of me yet," said Welles in deep sincerity. "Don't tell me anything more today; I couldn't take it. I'm going home. Maybe by tomorrow I'll see the joke and come back to laugh. Tim, did you ever fail at anything?"

"There are two cabinets full of articles and stories that didn't sell. Some of them I feel bad about. There was the chess story. You know, in 'Through the Looking Glass,' it wasn't a very good game, and you couldn't see the relation of the moves to the story very well."

"I never could see it at all."

"I thought it would be fun to take a championship game and write a fantasy about it, as if it were a war between two little old countries, with knights and foot-soldiers, and fortified walls in charge of captains, and the bishops couldn't fight like warriors, and, of course, the queens were women—people don't kill them, not in hand-to-hand fighting and . . . well, you see? I wanted to make up the attacks and captures, and keep the people alive, a fairy-tale war you see, and make the strategy of the game and the strategy of the war coincide, and have everything fit. It took me ever so long to work it out and write it. To understand the game as a chess game and then to translate it into human actions and motives, and put speeches to it to fit different kinds of people. I'll show it to you. I loved it. But nobody would print it. Chess players don't like fantasy, and nobody else likes chess. You have to have a very special kind of mind to like both. But it was a disappointment. I hoped it would be published, because the few people who like that sort of thing would like it *very* much."

"I'm sure I'll like it."

"Well, if you do like that sort of thing, it's what you've been waiting all your life in vain for. Nobody else has done it." Tim stopped, and blushed as red as a beet. "I see what grandmother means. Once you get started bragging, there's no end to it. I'm sorry, Peter."

"Give me the story. I don't mind, Tim brag all you like to me; I understand. You might blow up if you never express any of your legitimate pride and pleasure in such achievements. What I don't under-

stand is how you have kept it all under for so long."

"I had to," said Tim.

The story was all its young author had claimed. Welles chuckled as he read it, that evening. He read it again, and checked all the moves and the strategy of them. It was really a fine piece of work. Then he thought of the symphony, and this time he was able to laugh. He sat up until after midnight, thinking about the boy. Then he took a sleeping pill and went to bed.

The next day he went to see Tim's grandmother. Mrs. Davis received him graciously.

"Your grandson is a very interesting boy," said Peter Welles carefully. "I'm asking a favor of you. I am making a study of various boys and girls in this district, their abilities and backgrounds and environment and character traits and things like that. No names will ever be mentioned, of course, but a statistical report will be kept, for ten years or longer, and some case histories might later be published. Could Timothy be included?"

"Timothy is such a good, normal little boy, I fail to see what would be the purpose of including him in such a survey."

"That is just the point. We are not interested in maladjusted persons in this study. We eliminate all psychotic boys and girls. We are interested in boys and girls who succeed in facing their youthful problems and making satisfactory adjustments to life. If we could study a selected group of such children, and follow their progress for the next ten years at least and then publish a summary of the findings, with no names used—"

"In that case, I see no objection," said Mrs. Davis.

"If you'd tell me, then, something about Timothy's parents—their history?"

Mrs. Davis settled herself for a good long talk.

"Timothy's mother, my only daughter, Emily," she began, "was a lovely girl. So talented. She played the violin charmingly. Timothy is like her, in the face, but has his father's dark hair and eyes. Edwin had very fine eyes."

"Edwin was Timothy's father?"

"Yes. The young people met while Emily was at college in the East. Edwin was studying atomics there."

"Your daughter was studying music?"

"No; Emily was taking the regular liberal arts course. I can tell you little about Edwin's work, but after their marriage he returned to it and . . . you understand, it is painful for me to recall this, but their deaths were such a blow to me. They were so young."

Welles held his pencil ready to write.

"Timothy has never been told. After all, he must grow up in this world, and how dreadfully the world has changed in the past thirty years, Dr. Welles! But you would

not remember the day before 1945. You have heard, no doubt of the terrible explosion in the atomic plant, when they were trying to make a new type of bomb? At the time, none of the workers seemed to be injured. They believed the protection was adequate. But two years later they were all dead or dying."

Mrs. Davis shook her head, sadly. Welles held his breath, bent his head, scribbled.

"Tim was born just fourteen months after the explosion, fourteen months to the day. Everyone still thought that no harm had been done. But the radiation had some effect which was very slow—I do not understand such things—Edwin died, and then Emily came home to us with the boy. In a few months she, too, was gone."

"Oh, but we do not sorrow as those who have no hope. It is hard to have lost her, Dr. Welles, but Mr. Davis and I have reached the time of life when we can look forward to seeing her again. Our hope is to live until Timothy is old enough to fend for himself. We were so anxious about him; but you see he is perfectly normal in every way."

"Yes."

"The specialists made all sorts of tests. But nothing is wrong with Timothy."

The psychiatrist stayed a little longer, took a few more notes, and made his escape as soon as he could. Going straight to the school, he had a few words with Miss Page and then took Tim to his office, where he told him what he had learned.

"You mean—I'm a mutation?"

"A mutant. Yes, very likely you are. I don't know. But I had to tell you at once."

"Must be a dominant, too," said Tim, "coming out this way in the first generation. You mean—there may be more? I'm not the only one?" he added in great excitement. "Oh, Peter, even if I grow up past you I won't have to be lonely?"

There. He had said it.

"It could be, Tim. There's nothing else in your family that could account for you."

"But I have never found anyone at all like me. I would have known. Another boy or girl my age—like me—I would have known."

"You came West with your mother. Where did the others go, if they existed? The parents must have scattered everywhere, back to their homes all over the country, all over the world. We can trace them, though. And, Tim, haven't you thought it's just a little bit strange that with all your pen names and various contacts, people don't insist more on meeting you? People don't ask about you? Everything gets done by mail? It's almost as if the editors are used to people who hide. It's almost as if people are used to architects and astronomers and composers whom nobody ever sees, who are only names in care of other names at post office boxes.

There's a chance—just a chance, mind you—that there are others. If there are we'll find them."

"I'll work out a code they will understand," said Tim, his face screwed up in concentration. "In articles—I'll do it—several magazines and in letters I can inclose copies—some of my pen friends may be the ones—"

"I'll hunt up the records—they must be on file somewhere—psychologists and psychiatrists know all kinds of tricks—we can make some excuse to trace them all—the birth records—"

Both of them were talking at once, but all the while Peter Welles was thinking sadly, perhaps he had lost Tim now. If they did find those others, those to whom Tim rightfully belonged, where would poor Peter be? Outside, among the puppies—

Timothy Paul looked up and saw Peter Welles' eyes on him. He smiled.

"You were my first friend, Peter, and you shall be forever," said Tim. "No matter what, no matter who."

"But we must look for the others," said Peter.

"I'll never forget who helped me," said Tim.

An ordinary boy of thirteen may say such a thing sincerely, and a week later have forgotten all about it. But Peter Welles was content. Tim would never forget, Tim would be his friend always. Even when Timothy Paul and those like him should unite in a maturity undreamed of, to control the world if they chose, Peter Welles would be Tim's friend—not a puppy, but a beloved friend—as a loyal dog, loved by a good master, is never cast out.

THE END

MARTIN PEARSON had a story in "The Treasury of Science Fiction."

WE have a check waiting for him.

BUT he isn't going to get it until he lets us know where he is.

Come Out! Come Out wherever you are!

PERIOD PIECE

BY J. J. COUPLING

***It was** a strange sort of conspiracy they had arranged —a curious situation for any intelligence to be in. And, of course, no possible escape whatever!*

Illustrated by Orban

It was at that particular party of Cordoban's that he began actually to have doubts—real doubts. Before, there had been puzzlement and some confusion. But now, among these splendid people, in this finely appointed apartment, he wondered who he was, and where he was.

After his friend—or, his keeper?—Gavin had introduced him to his host, there was a brief conversation about the twentieth century. Cordoban, a graying man with both dignity and alertness, asked the usual questions, always addressing Smith with the antique title, Mister, which he seemed to relish as an oddity. To Smith it seemed that Cordoban

received the answers with the sort of rapt attention a child might give to a clever mechanical toy.

"Tell me, Mr. Smith," Cordoban said, "some of the scientists of your day must have been philosophers as well, were they not?"

Smith could not remember having been asked just this question before. For a moment he could think of nothing. Then, suddenly, as always, the knowledge flooded into his mind. He found himself making a neat little three-minute speech almost automatically. The material seemed to arrange itself as he spoke, telling how Einstein forced an abandonment of the idea of simultaneity, of Eddington's idea that the known universe is merely what man is able to perceive and measure, of Milne's two time scales, and of the strange ideas of Rhine and Dunne concerning pre-cognition. He had always been a clever speaker, ever since high school, he thought.

"Of course," he found himself concluding, "it was not until later in the century that Chandra Bhopal demonstrated the absurdity of time travel."

Cordoban stared at him queerly. For a moment Smith was scarcely conscious of what he had said. Then he formulated his thoughts.

"But time travel *must* be possible," he said, "for I am a twentieth century man, and I am here in the thirty-first century."

He looked about the pleasant room, softly lighted, with deep recesses of color, for assurance, and at the handsome people, grouped standing or sitting in glowing pools of pearly illumination.

"Of course you're here, fellow," Cordoban said, reassuringly.

The remark was so true and so banal that Smith scarcely heard it. His thoughts were groping. Slowly, he was piecing together an argument.

"But time travel *is* absurd," he said.

Cordoban looked a little annoyed and made a nod with his head which Smith did not quite follow.

"It was shown in the twentieth century to be absurd," he persisted.

But, had it been shown in *his* part of the twentieth century, Smith wondered?

Cordoban glanced to his left.

"We know very little about the twentieth century," he said.

Gavin knows about the twentieth century, Smith thought.

Then, following Cordoban's glance, he saw that a young woman had detached herself from a group and was moving toward them. A segment of the pearly illumination followed her, making her a radiant creature indeed.

"Myria," Cordoban said, smiling, "you particularly wanted to meet Mr. Smith."

Myria smiled at Smith.

"Indeed, yes," she said. "I've always been curious about the twentieth century. And you must tell me about your music."

Cordoban bowed slightly and withdrew, the light which had been

playing on him, seemingly from nowhere, detaching itself from the pool about Myria and Smith. And Smith's doubts fled to the back of his mind, crowded out, almost, by a flood of thoughts about music. And Myria was an enchanting creature.

Smith felt very chipper the next morning as he rose and bathed. The twentieth century had nothing like this to offer, he reflected. He knit his brows for a moment, trying to remember just what his room had been like, but at that moment the cupboard softly buzzed and he withdrew the glass of bland liquid which was his breakfast. His mind wandered idly while he sipped it. It wasn't until he walked down the corridor and sat in the office opposite Gavin that his doubts at Cordoban's returned to his mind.

Gavin was droning out the schedule.

"We have a pretty full day, Smith," he said. "First, a couple of hours at the Lollard's country estate. We can stop by the Primus's on the way back. Then, a full afternoon at a party given by the decorators' council. In the evening—"

"Gavin," Smith said, "why do we see all these people?"

"Why," Gavin answered, a little taken aback, "everyone wants to see a man from the twentieth century."

"But why *these* people?" Smith persisted. "They all ask the same questions. And I never see them again. I just go on repeating myself."

"Are we too frivolous by twentieth century standards?" Gavin asked, smiling and leaning back in his chair.

Smith smiled back. Then his thoughts troubled him again. Cordoban hadn't been frivolous.

"How much do *you* know about the twentieth century, Gavin?" he asked, keeping his tone light.

"Pretty much what you do," Gavin replied.

But this couldn't be! Gavin appeared to be a kind of social tutor and arranger of things. As far as Smith could remember, mostly, information had passed from Gavin to him, not from him to Gavin. He decided to pursue the matter further, and as Gavin leaned forward to glance at the schedule again, Smith spoke once more.

"By the way, Gavin," he asked, "who is Cordoban?"

"Director of the Historical Institute, of course. I told you before we went there," Gavin replied.

"Who is Myria?" Smith asked.

"One of his secretaries," Gavin said. "A man like him—he always has one on call."

"Cordoban said that not much was known about the twentieth century," Smith remarked mildly.

Gavin started up as if he had been stung. Then he sank back and opened his mouth. It was a moment before he found the words, however.

"Directors—" he said, and waved his hand as if brushing the matter aside.

Smith was really puzzled now.

"Gavin," he said, "is time travel possible?"

If Gavin had been startled, he was at his ease now.

"You're *here*," he said, "not in the twentieth century.

Gavin spoke in so charming and persuasive a manner that Smith felt like a fool for a moment. His thoughts were slipping back toward the schedule when he realized, *that wasn't an answer.* It wasn't even couched as one. But this was silly, too. If it wasn't an answer, it was just what one would say.

Still, he'd try again.

"Gavin," he said, "Cordoban—"

"Look here," Gavin broke in with a smile, "you'll get used to us in time. We'll keep the Lollard's and their guests waiting if we don't start now. It isn't asking too much of you to see them now, is it? And you'll like it. They have a lovely fifteenth century Chinese garden, with a dragon in a cave."

After all, Smith thought, he did owe his collective hosts of the thirty-first century something. And it was amusing.

The Lollard's garden was amusing, and so was the dragon, which breathed out smoke and roared. Primus's was dull, but the decorators' council had a most unusual display of fabrics which tinkled when they were touched, and of individual lighting in color. The evening was equally diverting, and delightful but strange people asked the same frivolous questions. Smith was diverted enough so that his doubts did not return until late that night.

But when Gavin left him at his door, he did not go to his bed and his usual dreamless sleep. Instead, he sat down in a chair, closed his eyes, and thought.

What did these people know about the twentieth century? Gavin had said, what he, Smith, knew. But that must be a great deal. An adult man, he, for instance, had a huge store of memories, accumulated over all his years. The human brain, he found himself thinking, has around ten billion nerve cells. If these were used to store words on a binary basis, they would hold some four hundred million words—a prodigious amount of learning. Tokayuki had, in 2117—

Strange, but he didn't remember talking with Gavin or anyone else about Tokayuki! And he could not have remembered about a man who had lived a century after his. But he could pursue this later.

Getting back to the gist of the matter, Cordoban had said that he knew little about the twentieth century. Yet Cordoban had not seemed anxious to question him at length. A few words about the philosophy of science, a dry enough subject, and he had called his secretary Myria—yes, Smith now saw, Cordoban had called Myria to relieve himself of Smith's presence. Here was an obviously astute man, and an historian, foregoing an opportunity to

learn about an era of which he professed ignorance.

Well, I suppose one untrained man doesn't know much about an era, even his own, Smith thought. That is, not by thirty-first century standards. But, then, how do they know what I know? he wondered. Nobody has asked me any very searching questions.

Gavin and his schedules, now! All the occasions were purely social. That was strange! Most of the people weren't those likely to have much detailed interest in another era. Decorators; some, like the Lollard's, apparently entirely idle—retired, perhaps. Anyway, the conversation was so much social chitchat.

Cordoban, now, had been an historian, even though he hadn't been curious. But that, too, was a purely social occasion. And Gavin himself! Just a sort of guide to a man from another age. Certainly not a curious man. Why not? Were men of the twentieth century so common here? But certainly he would have been brought into contact with others. Besides, time traveling was absurd!

But that was getting off the track. He *was* here. He didn't need Cordoban or Gavin to assure him of that. Being here, he would expect serious questioning by a small group—not all these frivolous, if delightful, parties. Surely he could tell them a great deal they had not asked.

Well, for instance, what could he tell them? His own personal experiences. What had happened day by day. But what *had* happened day by day? His schooling, for one thing. High school, in particular. As he thought about high schools, there quickly rose in his mind a sequence of facts about their organization and curriculum. It was as if he were reviewing a syllabus on the subject.

The three-minute talks were getting him, he decided. He was so used to these impersonal summaries that they came to his mind automatically. Right now, he must be tired. He would spend more time thinking in the morning.

So Smith went to bed, thought about the events of the day a little, including the Lollard's amusing fire-breathing dragon, and was quickly asleep.

The following morning Smith did not feel chipper. He rose and bathed out of a sense of duty and routine. But then he sat down and ignored the buzzing of the cupboard which announced his breakfast. A pattern had crystallized in his mind over night. His thoughts in their uncertainty had paved the way for this, no doubt. But what was in his mind was no uncertain conclusion.

He, Smith, was no man of the twentieth century! He had carefully implanted memories, factual theses concerning his past, summaries of twentieth century history. But no real past! The little details

that made a past were missing. Time travel was absurd. He was a fraud! An impostor!

But whom was he fooling? Not Gavin, he saw now. Not men like Cordoban. Was he fooling anyone? All of the people seemed eager to talk with him. Cordoban himself had been eager to talk with him. Cordoban had not been feigning. Cordoban had not been fooled. It seemed likely that Smith himself was the only one fooled.

But why? It was a stupid trick for people so obviously intelligent. What did they get out of this silly game? It could hardly be any personal quality of his—any charm. They were all so charming themselves.

Myria, Cordoban's secretary, for instance. A lovely woman. Handsome, poised, beautifully dressed. Suddenly a little three-minute talk about women in the twentieth century formed in Smith's mind. In part of his mind, that is. In a way, he watched it unfold. And with surprise.

He had thought of Myria as merely handsome and handsomely dressed. But even across the centuries—no, he must remember that he was not from the twentieth century. Across whatever gulf there was, there could have been more than this. Just how did he, Smith, differ from other men?

Well, what did he know of mankind? He reviewed matters in his mind, and went through little summaries on psychology, anthropology and physiology. It was in the midst of this last that he felt a horrible conviction which changed his course from thought to action.

His first action was to wind a small gold chain which was a part of his clothing tightly around the tip of his index finger. The tip remained smooth and brown.

Dropping the chain, he dug the sharp point of a writing instrument into his fingertip, ignoring the pain. The point passed into the rubbery flesh. There was no blood! But there was a little flash and a puff of vapor, and the finger went numb.

He was a cleverly constructed period piece, like the Lollard's dragon! Like a clockwork nightingale! That was why these people admired him briefly, for what he was—a charming mechanical toy!

Smith scarcely thought. The little review of twentieth century psychology returned to his mind, and automatically he opened the door onto the balcony and stepped over the railing. Consistent to the last, he thought in dull pain as he fell toward the ground twenty stories below.

But it wasn't the last. There was a terrible wrenching shock, a clashing noise, and confusion. Afterwards, there were still vision and hearing. True, the world stood at an odd angle. He saw the building leaning crazily into the sky. From the brief synopsis of physiology he gleaned that his psycho-kinetic sense was gone. He no longer felt which

way his head and eyes were turned. Other senses than sight and sound were gone as well, and when he tried he found that he could not move. Junk, lying here, he thought bitterly. Not even release! But now he could see Gavin bending over him, and another man who looked as if he might be a mechanic.

"Junk," the mechanic said. "It's lucky we couldn't put the brain in that, or it would be gone, too. Making a new body won't be so bad," he added.

"I suppose we'll have to turn off the brain and reform the patterns," Gavin mused.

"You'd have had to, anyway," the mechanic said. "You must have put in something inconsistent or we wouldn't have had this failure."

"It's a shame, though," Gavin said. "I got to like him. Silly, isn't it? But he seemed so nearly alive. We spent a lot of time together. Now everything that happened, everything he learned, will have to be wiped out."

"You know," the mechanic said, "it gives me the creeps, sometimes. I mean, thinking, if I were just a body, connected by a tight beam to a brain off somewhere. And if, when the body was destroyed, the brain—"

"Nonsense," said Gavin.

He gestured toward Smith's crumpled body, and then up toward the building where, presumably, was Smith's brain.

"You'll be thinking that that thing was conscious, next," he said. "Come on; let's turn the brain off."

Smith stared numbly at the crazily leaning building, waiting for them to turn off his brain.

THE END

THE ANALYTICAL LABORATORY

With two Ann Labs to report on, the space limited, we detail only the results, as follows:—

July, 1948

Place	Story	Author	Points
1.	Dreadful Sanctuary (II)	Eric Frank Russell	1.53
2.	Police Operation	H. Beam Piper	2.34
3.	Burning Bright	J. S. Browning	2.64
4.	Decision Illogical	Neal Wilkinson	3.25

(*Continued on page 106*)

THE "BRICKWALL" IN THE SKY

By WILLY LEY

The problems of supersonic speeds are, curiously, not encountered at supersonic speed! It's something like the problem of establishing a base on the Moon—not too hard, once you get there!

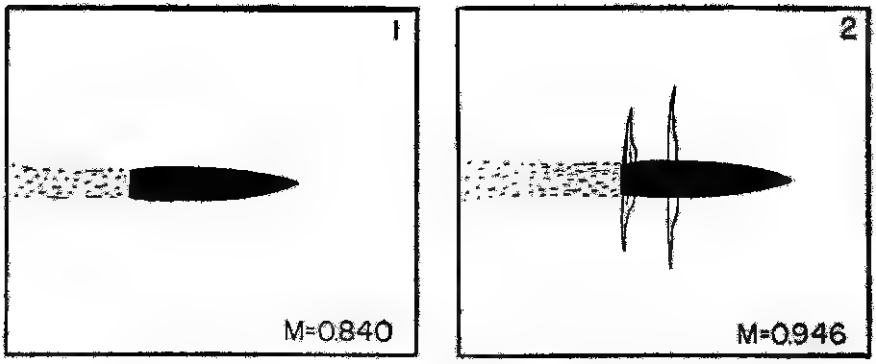
Illustrated by Willy Ley

Of course no Public Opinion poll on the subject of supersonic flight has actually been conducted, but if one had been made the results would probably look as follows: Eighteen and a half percent of all adult newspaper-reading Americans would claim to have no opinion about the matter. One and a half percent would answer with formulae or in a terminology which the public opinion researcher would not understand. The remaining eighty percent would be convinced that there is a brickwall in the sky and that the rocket airplane XS-1 has a sharp needle nose in order to pierce that wall.

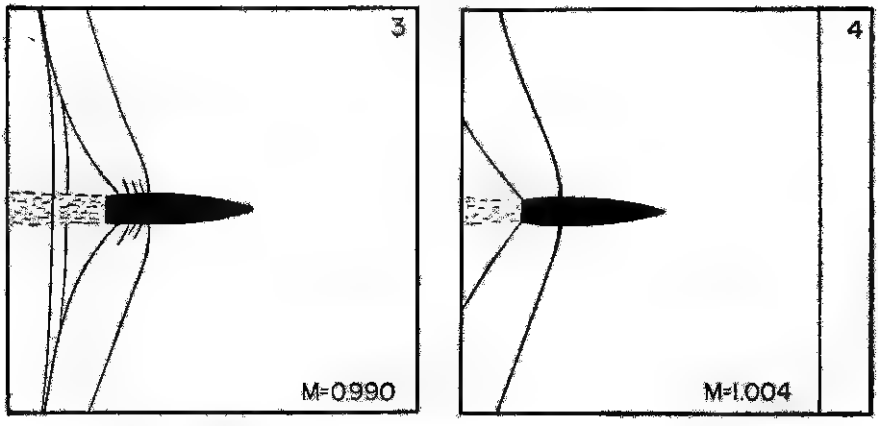
The fault lies with the daily papers who have dinned the term "transonic wall" into the ears of the public. But farther back it lies with wartime news releases about "compressibility effects" which—I don't have the means of checking that point—were either wrong to begin with or were thoroughly misunderstood by the rewrite men in the newspaper offices.

At about the time when the compressibility stories began to appear in the daily press the same topic was also discussed at another intellectual level in the classrooms of aerodynamical institutions. Listening in on those lectures you heard the professor explain to his students —in and out of uniform—why airplanes should not fly faster than 400-450 m.p.h. Stories were told of experimental craft battered by compressibility effects. Diagrams were drawn on blackboards. Figures were written down. And over everything the term Mach Number hovered darkly like a sinister spirit of vengeance. And if somebody even thought of another hundred miles per hour, say about 550 m.p.h. the expression *Mach point seven* was ominously raised like a threatening war club and the bold thinker quickly shut both mouth and mind.

While this was going on at the north end of the town, there was an artillery proving ground south of the same town where soldiers were trained to handle long barreled



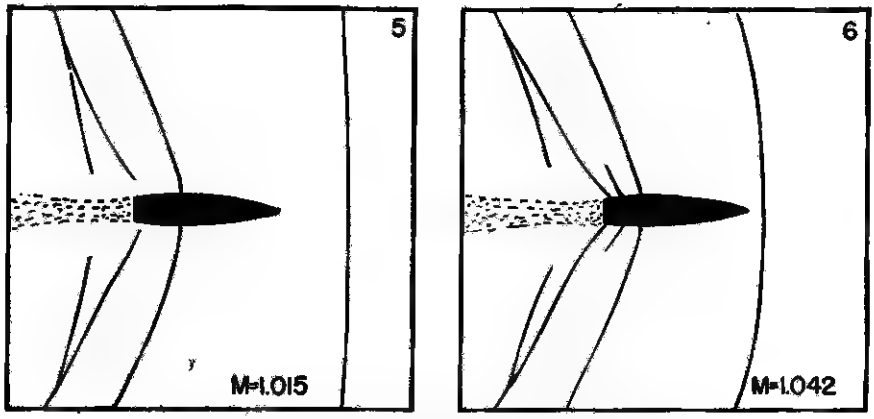
155 mm artillery projectile at Mach Number 0.840
" " " " " " 0.946



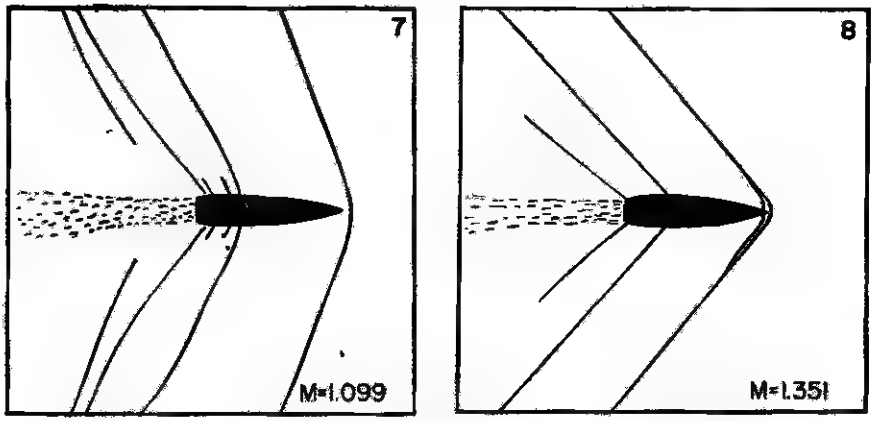
155 mm artillery projectile at Mach Number 0.990
" " " " " " 1.004

guns. The projectiles emerged from the muzzles with Mach number 3—and nobody even thought about it.

The idyll of the worship of M, the symbol of the Mach number, or rather of M^2, the form in which it usually appears in the formulae, did not remain undisturbed by war news. There was that German rocket plane, the Messerschmitt *Komet*—Me 163B—which did 550 m.p.h. and sometimes even a little more without being swallowed by an enraged M^2. And, unbeknownst to the inhabitants of the western shore of the Atlantic Ocean at that time, V-2 rockets rose from Peenemünde, going to Mach 6 and usually staying in one piece until they crashed into the ground.



155 mm artillery projectile at Mach Number 1.015
" " " " " " 1.042

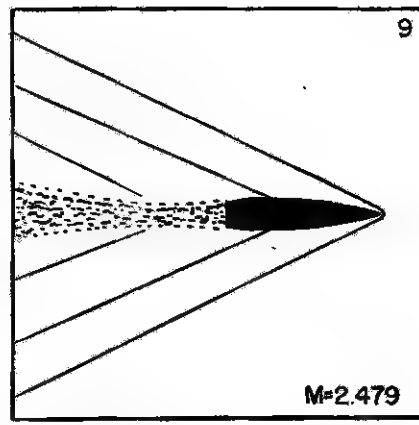


155 mm artillery projectile at Mach Number 1.099
" " " " " " 1.351

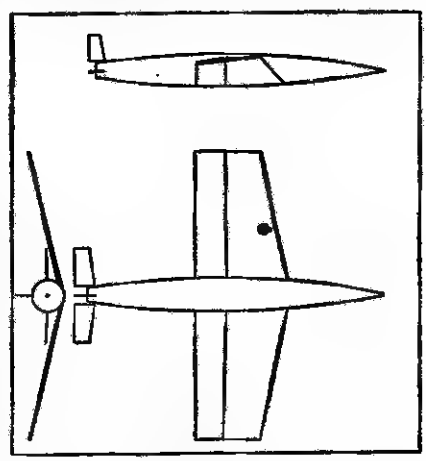
Before we go on, that term Mach number which, handled wisely, does a lot of good, should be explained. Originally it was the name of an Austrian physicist who devoted his time and energy to the study of just such phenomena as now bear his name. By definition the M number is the speed of an airplane—or rocket, or projectile—relative to the surrounding air, divided by the speed of sound at the altitude at which the plane flies. If we say that the speed of sound near sea level is 760 m.p.h., a plane flying with 380 m.p.h. is flying with M = 0.5. The

use of this ratio is advantageous for various reasons, but mainly because the speed of sound is not such a definite quantity as for example the speed of light. While sound travels at about 760 m.p.h. near sea level it is a full 100 m.p.h. slower in the stratosphere, say at forty thousand feet. Hence the plane which flies with $M = 0.5$ at sea level, flies with $M = 0.58$ in the stratosphere, provided, of course, that the speed of the plane itself did not change.

With the aid of the Mach number it is possible to distinguish several definite speed ranges. One is the normal or subsonic speed range which goes from $M = 0$ to $M = 0.8$. We'll soon see why the limit was placed at this point and not at a straight $M = 1$. On the other hand we have the clearly supersonic speeds like those of artillery projectiles from long naval rifles, bullets from high velocity portable rifles and large rockets going full blast. While the actual maximum velocities of such projectiles and rockets are on the order of $M = 2$ to $M = 6$ anything above $M = 1.35$ is called supersonic. The in-between region, from $M = 0.85$ to $M = 1.3$ is called the transonic region.



155 mm artillery projectile at Mach Number 2.479



First guess at appearance of rocket airplane: Sanger, 1934.

The three speed ranges find their explanation in the different manner in which air behaves at different speeds. The high school student who gets his first lessons in elementary physics is usually taught that the difference between gases and liquids lies in the fact that gases—as for example air—can be compressed, while liquids—as for example water—are to all intents and purposes incompressible. This is perfectly correct and true, but it is not the full story.

There is a difference in the behavior of air which is caught in a

closed container with a movable piston above it and free air which can get out of the way of moving things. At those speeds which are now defined as subsonic air does not behave like air, it gets out of the way of the moving wing or fuselage. Notwithstanding the fact that air *can* be compressed, it isn't compressed. One may say that at subsonic speeds air behaves like water.

At supersonic speeds, since air cannot, generally speaking, move faster than the speed of sound, it cannot help being compressed by fast moving bodies. At supersonic speeds, therefore, air behaves like air, it can be and *is* compressed. In the transonic in-between range air changes over from one kind of behavior to the other kind and that is wherein the trouble lies. There is a subsonic flow pattern which is nice and clear, even if not overwhelmingly simple. There is a supersonic pattern about which roughly the same things may be said. But at transonic speeds you have a mixture of both and it is not a palatable mixture. To design an airplane which will be reliable in this region of mixed patterns looks plainly and simply impossible at this moment. And for all we know it might *be* impossible. Until that fact is established and nicely proved with a large set of equations about which not only all the experts but also the experimental results are in agreement we know of only two ways of dealing with the transonic scramble of flow patterns. Both spell avoidance and one way is to stay below. The other is to go above, so that the plane is clearly in a well-defined speed range.

Because of all the talk about the "transonic wall" it should be called the speed range of flow pattern confusion—it might be useful to point out that neither projectiles nor rockets have any trouble passing from subsonic into supersonic speeds. In the case of a projectile this takes place inside the barrel, of course, since the projectile emerges with the maximum velocity which it is ever going to have during its short lifetime. But a V-2 rocket, starting out with something like 40 ft/sec. does not begin to fight or jaw or buck when its speed builds up to $M = 0.9$. It does not fall back to gather strength to burst through the "wall." It just goes on and becomes supersonic in due course, if you know the constants, the variables and the proper method of applying them you can write down the speed the rocket should have for any second of its climb. And unless the rocket has ruptured a fuel line at take off—which sometimes happens due to the vibrations of the rocket motor while it builds up its thrust from about six to about twenty-seven tons—it will have the calculated velocity.

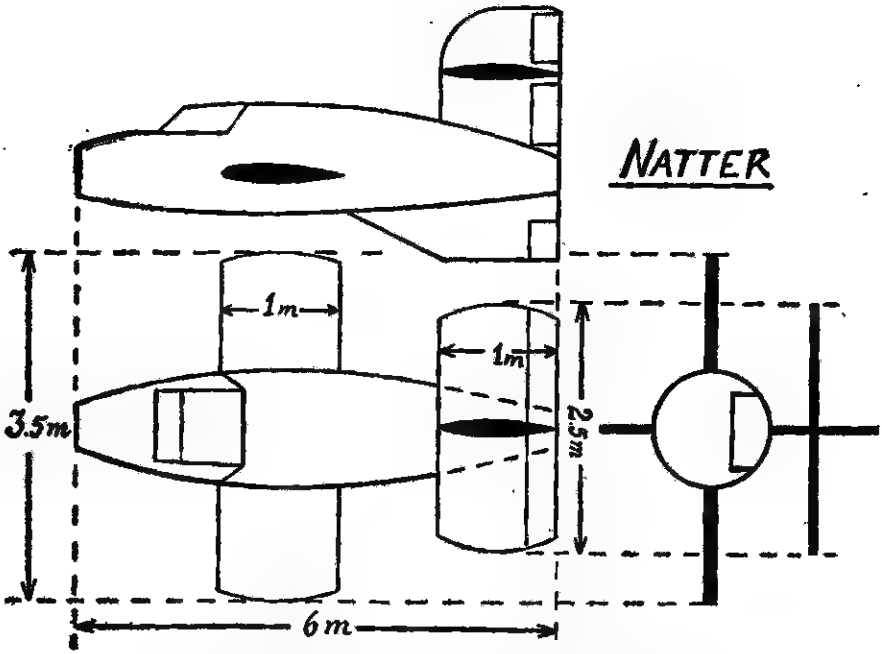
Of course there are shock waves when the rocket travels at supersonic speed, but that fact can be found in books about exterior ballistics—which is the movement of the projectile after it has left the gun

muzzle—for a good number of years. In fact most of these books even show photographs of such shock waves, a method of photographing them was developed some three to four decades ago. This method is known as the schlieren method—and any day now I expect to read somewhere about "shock waves photographed with the method originally developed by Herr Professor Dr. Schlieren." Actually the word *schlieren*—it is the plural of the German word *schliere* —means areas of unequal density, as for example poor sections in optical glass. In the case of photographs of shock waves we might just as well call it the striation method. But no matter what the name, it produces results which are as interesting as they are valuable.

The Ballistic Research Laboratory at Aberdeen, Maryland, recently released a very beautiful set of such schlieren photographs of a 155 millimeter—"Long Tom" -projectile of which drawings 1-9 are a selection. It pays to look at them carefully.

At $M = 0.840$ the projectile just moves along trailed by a wake of turbulence. Of course some air will be compressed somewhat in front, but not yet enough to form visible shock waves. At a slightly higher speed, at $M = 0.946$ two sets of shock waves begin to blossom out from the projectile. They are still weak and small but as the speed increases they won't stay that way. At $M = 0.990$ they are large and clear but still they are all around the rear end of the projectile, presumably caused by the driving bands. At $M = 1.004$ a new factor enters the picture—literally—a shock wave traveling ahead of the projectile. It is still almost a straight line in the drawing, but it begins to show a definite curvature at $M = 1.015$. The pattern of the other shock waves has changed little, however. At $M = 1.042$ the frontal or advance shock wave is still ahead of the projectile but has assumed the shape of a part of a sphere. At $M = 1.099$ it has changed to a very shallow cone, still traveling ahead of the shell. At $M = 1.351$ the shock wave which had traveled ahead has become a bow wave, curved near the projectile but straight farther out. The whole bow wave forms a wide-angled cone. This cone becomes more and more sharp angled as the speed of travel increases. The last picture of the series shows the shape of the shock waves at $M = 2.479$, the cone formed at that speed has an opening of about 50°.

Obviously the angle of that cone could be used to judge the speed of a projectile. That this has to be the case can be shown quite simply. We'll imagine first that we have a stationary and *small* disturbance at the point P. Let's phrase it by saying that there is a "pulsating point" at P. It causes disturbances in the air which travel outward in all di-



German rocket interceptor "Natter" (viper).

rections, hence forming expanding spheres. They expand with the speed of sound. It is important to realize that these expanding spheres will gradually die out even if the medium in which they travel is entirely nonviscous. The reason for their dying out is that the area of the spheres increases very quickly, while the amount of energy which originally caused them is given, therefore there is less and less energy per square inch of expanding sphere.

Now the "pulsating point" begins to move. It moves with a speed considerably less than that of sound. The spheres still expand as before, and with the velocity of sound, as before. They are no longer concentric but that is unimportant. What is important is that the expanding spheres, so-to-speak the "signal" of the traveling point, arrive at a given place before the point does.

But when it moves with a speed greater than that of sound, when it moves faster than the expanding spheres, everything changes radically. The disturbance which causes the signal is faster than the signal itself, the expanding spheres are in the wake of their cause and all activity takes place in a space inclosed by a cone. Everything out-

side of that cone is so-to-speak completely unaware that something is going on, it is the area of "no signal." Quite logically supersonic aerodynamics have been called the "aerodynamics of no advance signal" for that reason.*

A few paragraphs back it was emphasized that the disturbance has to be small because only a small disturbance would produce such a clear picture as shown in the diagrams. A traveling projectile is not a small disturbance, of course, but a pretty big one. And since air *can* be compressed some air in front of such a large traveling disturbance *will* be compressed. That means that some air in front of the projectile will be forced to travel at a speed faster than sound, something which it cannot normally do. That means furthermore that there will be an advance signal for a short distance in the case of a large disturbance. And that is the reason why the bow wave of a projectile, still even at M = 1.351, does not form a sharp-pointed cone. Farther away the air behaves according to theory and the lines of the Mach cone become straight. Near the nose of the projectile they are not.

* Subsonic and supersonic flow differ radically in another respect too: If you have a subsonic flow through a convergent nozzle, the flow velocity will increase. If it is a supersonic flow to begin with, the flow velocity will decrease. The opposite holds true for divergent nozzles; if the flow through them is subsonic, it will decrease but if it is supersonic, it will increase. This behavior is utilized in the convergent-divergent nozzles of rocket motors. The flow starts with subsonic velocity in the combustion chamber, increases in speed because it flows through a convergent nozzle. It reaches and passes the speed of sound in the nozzle throat and then goes on increasing in speed because it is now a supersonic flow in a divergent nozzle.

While this explains the origin of the bow wave it does not account for the other shock waves, especially the ones which are presumably formed by the driving bands of the shell. To account for them we have to try and visualize how air will flow around a corner at supersonic speed. If we have a receding corner—Case A—in the area of the angle indicated by the two fine lines in the diagram, some so-called expansion waves will originate. The result is then a flow in the new direction with *lesser* density. But if we have a protruding corner—Case B—we get a literally impossible situation. In order to follow in the new direction, with incidental compression, the air should be able to go through an area of mutual interpenetration. The diagram naturally recalls similar diagrams showing the reflection of light rays from the surfaces of otherwise transparent glass. Well, light rays might be able to indulge in such a maneuver of self-penetrating reflection. Air cannot do that—and the result of trying is a shock wave.

The lessons which can be learned from all this are essentially quite simple. Anything supposed to move with supersonic speeds should be as smooth as possible since every unevenness of the surface, whether intentional or accidental, will cause a shock wave. And shock waves mean drag and cost energy, either in terms of speed or in terms of fuel. Of course anything supposed to move at supersonic speeds should

also not be blunt in front because the blunter the front the more air will be forced to travel at supersonic speeds by being compressed in front and carried along. This again means drag and costs money, one way or another. We'll see shortly how the designers of the XS-1 paid attention to these lessons.

By now everybody seems to take it for granted that the supersonic airplane will have to be a rocket propelled airplane. While this is not such a simple truth as it appears to be at first glance we'll postpone the power plant discussion and look at the rocket airplanes built so far.

There are three which at the moment of writing were finished and actually took to the air. One of them was the German *Natter*—viper—which was really more a personally-guided missile than a rocket airplane. The second was the Messerschmitt 163-B which was a rocket propelled fighter plane but which was rocket propelled merely for the sake of being faster than the propeller airplanes and jet-propelled airplanes of its time. It was not meant to be supersonic. The third is the XS-1 which was meant to be supersonic and which is not a fighter plane or, strictly speaking, any other specific type of airplane but a flying speed research laboratory.

Both the *Natter* and the Me-163 were designed around the Walter HWK 509 rocket motor; one of the two liquid fuel rocket motors which were manufactured in quantities like ordinary aircraft engines. (The other was the V-2 motor.) The Walter rocket motor weighed only three hundred sixty-five pounds without the fuel tanks. The motor proper consisted of a pump assembly and combustion chamber with exhaust nozzle. Maximum thrust of the motor was three thousand seven hundred forty pounds, but since a rocket motor's efficiency falls off sharply when throttled, the motor had an auxiliary chamber for cruising which produced a thrust of six hundred sixty pounds. By using both together a total thrust of four thousand four hundred pounds could be obtained, requiring a fuel supply of close to twelve hundred pounds per minute.

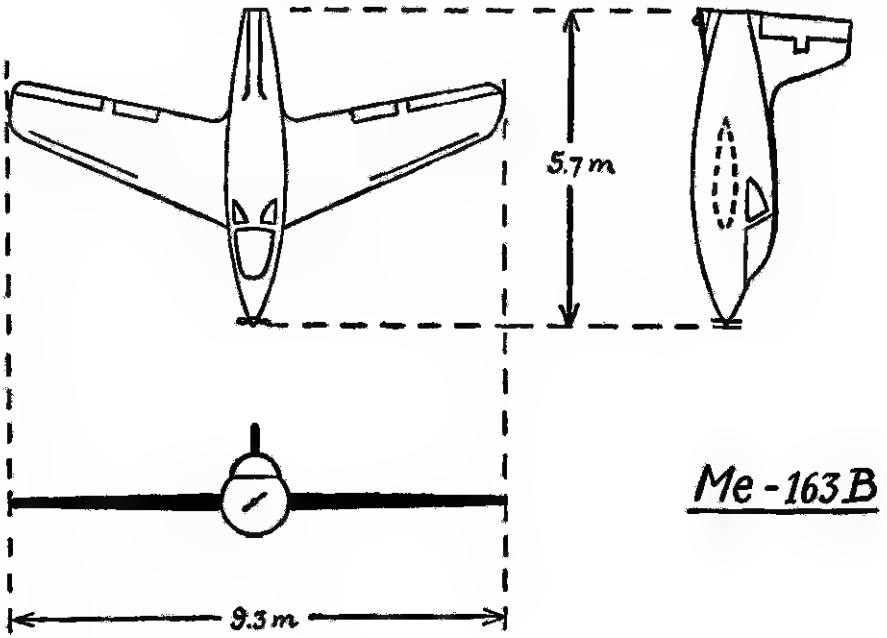
The oxidizer used in this motor was not liquid oxygen but highly concentrated hydrogen peroxide (H_2O_2). In order to eliminate an ignition system the fuel was not just alcohol, but alcohol with a rather large admixture of hydrazine hydrate, the latter being one of the chemicals which bursts into flames spontaneously when coming into touch with hydrogen peroxide.

The whole design of the *Natter* was such that it could be built quickly, in poorly equipped workshops by unskilled labor working with second-grade tools on uncritical materials, mostly wood. The *Natter* was to take off vertically from a short launching rack with the aid of solid fuel booster rockets

and was to be half-guided—from the ground—half piloted in the general direction of an approaching Allied bomber formation. Then the pilot was to fire his charge of twenty-four bombardment rockets which filled the front compartment of the *Natter*. Then, after unfastening his harness, he was to push his stick all the way forward, thereby activating a mechanism which would break the plane apart. First the nose was to be jettisoned. Then a powerful parachute attached to the valuable rocket motor was to be ejected from the rear end which, when opening, would stop the remainder of the plane so that the pilot would be thrown forward into the air where he would pull the ripcord of his own parachute.

The project had been originated as a last ditch stand against American and English bombing squadrons on August 1, 1944. In September 1944 models were tested in the high speed wind tunnel at Braunschweig with speeds close to M = 1. The fifteen specimens of the "viper" were produced and subjected to glide and launching tests. The launching tests usually meant the end of that particular plane, because the Schmidding solid fuel rockets which were to serve as boosters misbehaved in every respect. Many of them exploded, destroying the plane. Those that did not explode

German rocket-propelled fighter plane ME-163B "Komet."



showed an unbearable discrepancy in performance, their actual thrust was the specified figure plus/minus fifty percent!

One manned glide test was made in a motorless "viper" carrying the proper amount of ballast. In that test the nose jettisoning mechanism failed so that the pilot had to bail out in the customary manner. But he was enthusiastic about the flying characteristics otherwise. Only one manned launching was made which ended in a strange manner. At an altitude of some five hundred feet the cockpit cover which also carried the headrest for the pilot flew off and the plane turned on its back. In that position it climbed to about five thousand feet with an angle of climb of only about 15°. Then it dived into the ground. The pilot, of course, was dead, but probably lost consciousness long before the crash.

When the war ended one hundred fifty "vipers" were on order by the *Waffen SS* and fifty by the *Luftwaffe*. None had been delivered of course. There also was a rumor around that the German government had sold all the plans and construction details of the *Natter* to the Japanese government so that the Japanese might stop the American Air Force. So far nobody seems to know whether this was just a rumor or whether such a transaction actually took place. At any event no *Natter* ever rose from the Japanese islands.

But the Me-163B was used operationally; it was encountered by Allied airmen for the first time on August 16, 1944 over Leipzig, but seems to have been used earlier in —successful—attacks on single photographic planes. Its speed was 550 m.p.h.—M = 0.7—and it took off normally by means of a jettisonable wheeled undercarriage which dropped off when the plane was in flight. This was done by linking the undercarriage to the landing skid of the plane. At take-off the landing skid was extended; when it was retracted the undercarriage dropped off. For landing the skid was then extended again. The plane not only was faster in level flight than anything else in the air in the summer of 1944, it also had a phenomenal rate of climb, it took only about two and one half minutes to climb to thirty thousand feet. The plane was developed in 1943 from the Me-163A, an earlier training version and near the end of the war the Me-163C was developed out of the B model. The C model was slightly larger, used the Walter motor with cruising jet, had an endurance of twelve minutes, a maximum speed of five hundred ninety m.p.h. and a pressure cabin since its ceiling was fifty-two thousand feet. The B model was produced in considerable numbers but precise production figures were either not found or are still classified.

As has been said before neither the *Natter* nor the Me-163B and C were supposed to be supersonic.

The XS-1 is.

The story of the XS-1 was told for the first time rather completely in New York on January 28, 1947 at the Fifteenth Annual Meeting of the Institute of the Aeronautical Sciences in a lecture prepared by R. M. Stanley, Chief Engineer and R. J. Sandström, Chief Preliminary Design Engineer, both of Bell Aircraft Corporation. But at the last moment the lecture was made "restricted" so that not much could be said about it outside the lecture hall. Later the restriction was removed and the Institute of the Aeronautical Sciences could publish the lecture in the August 1947 issue of the *Aeronautical Engineering Review*. Quotes which appear in the following description are taken from the published version.

The first discussions about the XS-1 took place early in December 1944. Preliminary specifications were that the new plane should be a piloted supersonic research vehicle which should attain a minimum speed of eight hundred m.p.h. at thirty-five thousand feet—that would be Mach = 1.21—or higher for a period of from two to five minutes.

As the XS-1 finally emerged it may be described as a V-2 rocket laid on its side, equipped with wings, tail assembly and landing gear and a pilot in the instrument compartment, replacing the nine hundred seventy-five pounds of instruments in the German version by about one hundred eighty pounds of much more versatile organic matter. But such a description would cast unjustified aspersions on the designers, because the final similarity was one of necessity, not of choice.

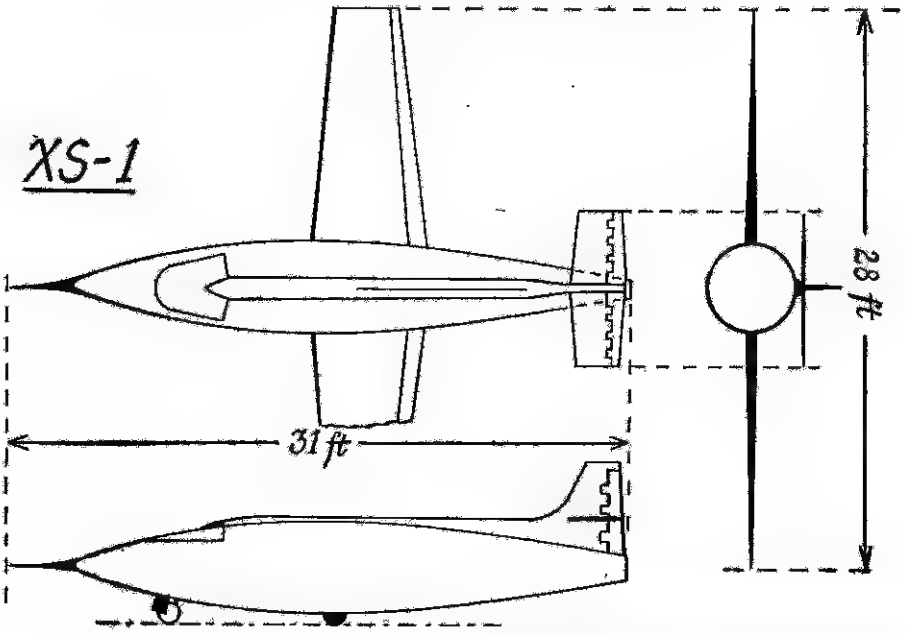
To begin with the designers of the XS-1 did not start out with the concept of a rocket airplane. Their goal was a plane to fit the preliminary specifications and they considered all power plants that might do it. Turbojets were high on their list, if not on top, but it was decided that the turbojets then available would not do it. As a matter of fact even now it is not certain whether turbojets could do it at all. The general performance figures of modern turbojets are such that they should be capable of producing a speed of Mach = 1. But these performance figures usually work with air of sea-level density or at fairly low altitudes, while a plane which is to approach or exceed the speed of sound should do so at a high altitude. But if you put the plane at an altitude where the air density is low the turbojets themselves labor for air.

"Consideration was then given"—I'm now quoting from the lecture—"to the combination of a turbojet and rocket power plant. The primary purpose of the turbojet was for take-off, climb to altitude and return to home base, while the rocket was to accelerate the airplane to, and maintain the desired speed after the operational altitude had been reached. This combination resulted in an excessively large air-

plane. The turbojet performance fell off at altitude, resulting in a poor rate of climb, which in turn called for a large amount of fuel. The speed at which the airplane was flying when the operational altitude was reached was also low, requiring a considerable amount of rocket fuel for acceleration purposes. The use of two such widely different power plants also increased the installation and operational problems. Although the fuel consumption of an all-rocket-powered airplane was high, the rate of climb was also high, averaging better than twenty thousand feet per minute between sea level and thirty-five thousand feet, with a climbing speed of five hundred m.p.h. Thus, the fuel required for climb was relatively low and that required to accelerate from climbing speed to desired test speed was less than with a combination turbojet and rocket. At higher altitudes the potential climbing speeds and rate of climb were even higher, reaching maximum values of one hundred twenty thousand feet per minute at an altitude of one hundred twenty thousand feet, flying at nearly fourteen hundred m.p.h. After a comparative analysis of the design studies made around the various power plants, it was decided to proceed with the all-rocket-powered airplane."

Just in order to avoid misunder-

American research rocket plane Bell XS-1.



standings it should be said that the figures given in this quote are, of course, the results of mathematical analysis and not test results.

Once the problem of the power plant was settled—too little was known about ram jets then to take them into consideration –the problem of the airplane's shape came up. First, of course, the take-off problem loomed large. It would have been best for the purpose intended to have the research airplane taken up by another larger airplane, for example a B-29, and released in air at a considerable flying speed. But the war was still going on, it was doubtful whether a B-29 could be commandeered for this purpose. And it was, of course, possible that the research airplane might lead to a fighter airplane. Therefore take-off under the plane's own power was decided upon. Whether the designers toyed with the idea of copying the jettisonable wheeled undercarriage of the Me-163 is something they don't say; at any event they decided on a retractable tricycle landing gear. Even if more had been known about ram jets, then the requirement of take-off under the plane's own power ruled them out.

As regards the shape, the canard type was suggested and discarded. Sweptback wings were mentioned in the discussions, but ruled out because very little was known about them at that time. The wings of the XS-1 are thin for aerodynamic reasons, the wing loading high, about one hundred pounds per square foot. The horizontal stabilizer is placed high up on the vertical stabilizer.

At launching the XS-1 weighs slightly over thirteen thousand pounds of which about eight thousand pounds are fuel. When landing the plane weighs four thousand eight hundred eighteen pounds and has a landing speed of about one hundred ten m.p.h.

"The pilot enters the cabin through a rectangular door on the right side of the fuselage, located in such a fashion that in case of bail-out he is forced to go downward, thereby increasing his chances of missing the tail. His cabin pressure is sealed with him prior to launching and no replenishment is necessary for a flight of this airplane's short duration. Internal cabin pressure is maintained at three pounds per square inch above atmosphere, which is sufficient to maintain pilot safety irrespective of altitude. The cabin is tested to leak at a rate no greater than one pound per square inch per hour at three pounds per square inch internal pressure."

After the general shape and size of the plane had been decided upon and also the general type of power plant design problems narrowed down to finer points, the power plant had to deliver six thousand pounds of thrust for slightly over four minutes. Obviously it was to be liquid fuel but which? *Natter* and Me-163B had used hydrogen peroxide as an oxidizer and alcohol

as a fuel. Whether the trick of adding hydrazine hydrate for spontaneous combustion was to be used or not with this combination did not matter. In this country the also spontaneously igniting combination of aniline and fuming nitric acid had been developed. The classical liquid rocket fuel was liquid oxygen with either gasoline or alcohol; gasoline being slightly more powerful but unsuitable for cooling the motor—therefore requiring a separate tank for a coolant, probably just water—while alcohol could be used for cooling the motor, especially since water could be added directly to the fuel.

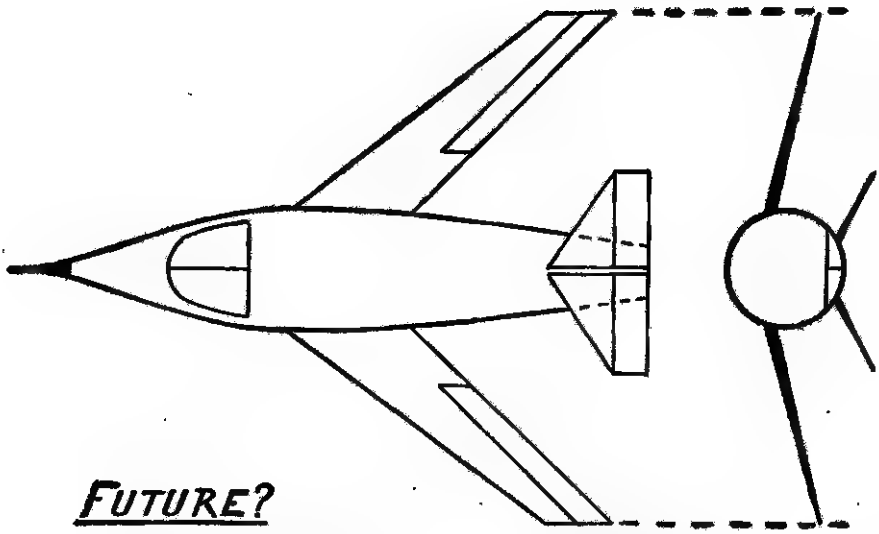
Unfortunately gasoline and water do not mix, and if you mix them by force, which can be done, they do not stay mixed. Mixtures of alcohol and water, on the other hand, are stable mixtures as any bartender will testify.

The designers of the XS-1 followed this line of reasoning. They discarded the hydrogen peroxide plus fuel combination because strongly concentrated hydrogen peroxide was not available in large quantities in this country then. Furthermore hydrogen peroxide is not completely trustworthy. The designers also decided that the acid and aniline combination was unsuitable for man-carrying aircraft. To begin with the acid is highly injurious to personnel, hard to handle in quantities and generally most unpleasant. Furthermore the much talked about elimination of an ignition system because of the spontaneous combustibility of aniline with acid is a double-edged sword when it comes to large systems. A few spilled drops here and a slight leak there and you have a fire which is apt not to be extinguishable. All this applies, too, to the German hydrogen peroxide plus hydrazine hydrate trick –several Me-163Bs were seen to blow up in midair, no doubt victims of dual leaks which may have been helped along by machine gun fire of Allied planes.

The designers of the XS-1 also looked at nitro-methane, a so-called mono-propellant not requiring a separate oxidizer but were not too happy about the experienced probability of sudden detonation. Therefore they reverted to the safest rocket fuel known today, the liquid oxygen/alcohol combination. Both components are easy and safe to handle after some practice, they are relatively nontoxic * and even a dual leak does not necessarily spell disaster since they are not self-igniting.

The firm of Reaction Motors, Inc. was charged with developing a rocket motor of six thousand pounds thrust, burning alcohol and liquid oxygen and having an endurance of more than four minutes. The engineers of Reaction Motors, Inc.

* Liquid oxygen may be considered completely nontoxic if handled in the open. As regards the toxicity of ethyl alcohol I am carefully refraining from sticking my neck out. Fact is, at any event, that during the British V-2 firings at Cuxhaven a mechanic who had crawled into the motor for a check-up did not come out again. He was finally pulled out and found to be happily unconscious and of no further use for these particular experiments. It seems that one of the fuel connections was leaking badly.



Future? Probable appearance of the XS-1's successors.

solved the problem by providing a motor consisting of four chambers of fifteen hundred pounds thrust each, operating at a chamber pressure of about two hundred thirty pounds per square inch and each supplied with its own igniting device. This device consists of a spark plug firing a mixture of fuel and gaseous oxygen; once the chamber burns no further ignition is required. Since this rocket motor is really four rocket motors which can be switched on and off independently, the pilot has four choices of thrust. This is highly advantageous not only from the point of view of structural strength of the plane—and of the pilot—but it also extends the duration of the flight, if desired.

After all this was done and accomplished another problem came up. How did one get the fuels from the tanks into the rocket motor? In the Walter motor the Germans had taken advantage of the fact that hydrogen peroxide can be broken up into oxygen and water by solid catalysts. Naturally the water appears as steam because of the heat developed by that reaction. The fuel pump in the Walter motor was therefore driven by a steam turbine fed with steam from hydrogen peroxide decomposed by means of solid catalysts. In the V-2 rocket the same reaction had been used for the same purpose: hydrogen peroxide and potassium permanganate, carried in separate small tanks, were brought together to generate steam, the steam drove a steam turbine and the turbine drove the pumps.

For the XS-1 a turbine driven

fuel pump had been specified, presumably to run on the same fuels as the rocket motor. But it was soon realized that this development would take longer than the development of everything else and compressed gas tanks were substituted for the pumps as an interim solution. It is not a very pretty solution, since, "this has reduced the airplane's endurance by about 1.5 minutes, has increased its landing weight by approximately two thousand pounds and has run the landing wing loading up to approximately fifty-five pounds per square foot." The fact that the end of the war made B-29s available for carrying the XS-1 up and eliminating take-off from the ground has fortunately about offset the disadvantage of pressurizing the fuel tanks.

It sounds so simple to say that nitrogen pressure tanks were substituted for the fuel pump and that that necessitated making the fuel tanks stand the gas pressure. But that was only a small part of the whole problem. Tanks to hold the compressed nitrogen had to be designed too. And then it turned out that these tanks should hold a higher pressure than two thousand two hundred pounds per square inch. Simple, just design them for whatever higher pressure is needed. Yes, simple, but how does one get the higher pressure inside? That figure of two thousand two hundred pounds per square inch is the limit at which nitrogen is commercially available.

Well, there was a way out. One could get liquid nitrogen and let it evaporate to the required pressure. This required an evaporator, a steel sphere made of stainless steel in two halves and welded together. The outside diameter of that sphere is thirty-six inches, its inside diameter thirty inches. The sphere was tested for nine thousand pounds per square inch and could be counted upon to hold. And then, when it was running, drops of liquid formed on the outside of the frosted pipe lines. Was there a leak somewhere? No, everything had been thoroughly tested, not just once or twice but many times. Moisture? Don't be ridiculous, the moisture which accumulates on a pipe through which liquid oxygen or liquid nitrogen are flowing freezes solid and does so instantly. A test was then made to determine the nature of the liquid which dropped off the pipe lines. It was liquid oxygen, condensed out of the air!

During February of 1946 ten glide tests were made. A B-29 took the XS-1 up to twenty-seven thousand feet and launched it there. The XS-1 returned to the ground in twelve minutes, making normal landings at about one hundred ten m.p.h.

These tests were made at or rather over Pinecastle, Florida. Then the plane was taken to Muroc Dry Lake in California which, ironically had been flooded while the Florida tests were going on. The

reason for this strange behavior is that the dry bottom of that former lake—it is shaped about like a figure 8—is so dry that rain water will not be absorbed, but has to evaporate. Over Muroc Dry Lake four more glide tests were made. Then came the first powered flight.

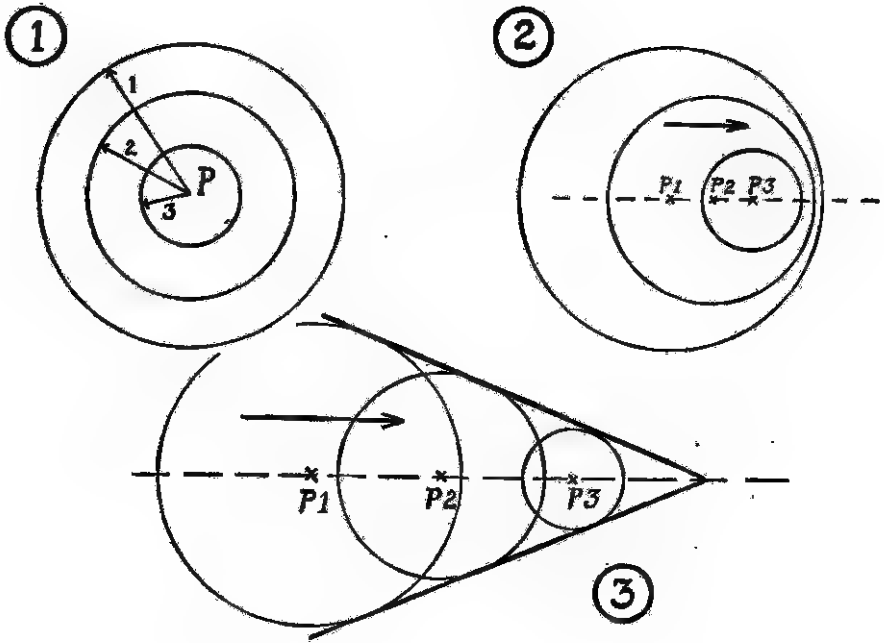
"On December 9, 1946, in perfect weather, the XS-1 was launched at twenty-seven thousand feet over Muroc Dry Lake. Approximately ten seconds later No. 1 rocket chamber was ignited, followed shortly by No. 2. The speed of the aircraft picked up so rapidly, however, that thrust was cut back to twenty-five percent for reasons of safety, and a slow climb was made to thirty-five thousand feet. The cabin noise level was reported to be low. At thirty-five thousand feet fifty percent thrust was again applied and a Mach Number of 0.79 quickly attained. All power was then shut down, the airplane glided down to fifteen thousand feet and, with all four rocket motors running, one hundred percent thrust was applied during a brief climb. The pilot experienced extremely high accelerations, which he compared to those of a fighter during take-off employing water injection. On its first powered flight the XS-1 reached a Mach Number of 0.795 during brief application of fifty percent thrust, demonstrated satisfactory motor control and general handling characteristics, and adhered closely to the flight plan. The eleven subsequent flights have been equally satisfactory."

This is how things stood in midsummer of 1947.

In December of the same year the magazine *Aviation News* caused a great stir by reporting that the XS-1, during the preceding months, had made several flights at supersonic speed and that no great trouble had been experienced in traversing the speed range of confused pattern:

Most of the stir caused by this announcement was of a nontechnical nature; it was a question of whether the magazine had broken security. If so, how. If not why not, and just what are the peacetime rights of the press and of the Air Force and so on. But the more important point was just one of those fine technical points. It was not that the XS-1 had become supersonic. One of my teachers used to say "if you put a sufficiently powerful engine on it, a barn door will fly." Likewise, if you push something hard and fast enough it will become supersonic. The point was that the first supersonic flight of all history had been made with straight wings.

The German experts had talked their American colleagues into a firm belief that the wings of supersonic aircraft would have to be swept back strongly. That was not a piece of postwar sabotage, the Germans believed it, too. And they had built their argument on very solid foundations. In fact it is still likely that swept-back wings would be superior. But the XS-1 proved that it could be done with straight



The origin of the so-called Mach cone:

1.) Stationary small disturbance, causing expanding spheres of pressure disturbance, traveling with the speed of sound.

2.) Same, but disturbance moving with a speed less than that of sound. A "signal" of the disturbance can still move ahead of the disturbance itself.

3.) Disturbance moving faster than sound, the "signal" lags behind the disturbance itself, hence there is no action or activity of any kind ahead of the disturbance. All action is confined to the expanding spheres behind the disturbances. The whole zone of action lies within a cone, touching the surfaces of the spheres and known as Mach cone.

No. 2 corresponds about to Mach Number 0.55
No. 3 " " " " " 2.20

wings, too. Somewhere there was a hole in the supporting theory or, if you want to, a loophole. Aerodynamicists are indubitably busy right now straightening out theory.

But the really important thing was that the performance of the XS-1 had broken down that superstition about a brickwall in the sky. Gun designers had never thought about it, rocket experts had never worried about it. Only aerodynamicists had talked themselves into a nonexistent corner, incidentally supplying the newspapers with copy. Of course one would not expect a Piper "Cub" to negotiate the transonic range—but then one also does not expect a Liberty Ship to dive under an iceberg.

Since this problem has been settled in the most convincing manner possible we can go on and ask "After XS-1, what?"

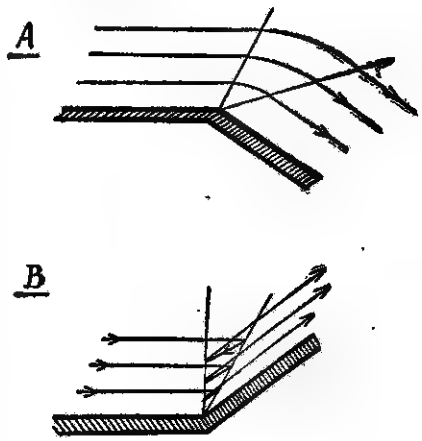
The rhetorical question of what is to come after XS-1 does not refer so much to its immediate successors —they will just be other research aircraft—but to the picture as a whole. How will the supersonic airplane develop in the years to come? How will it look? How will it be operated?

That it will be a rocket airplane is obvious by now. That its fuselage will have a circular cross section and generally the shape of a large rocket is also obvious. Also that its wings will be thin and virtually solid. In spite of the experience with XS-1 they may still show a sweepback.

But if the plane is to be used for anything but research it has to have range. Now the range of any airplane depends, according to a formula originally developed by Breguet, on three quantities. One is the amount of fuel required to produce a unit amount of useful work, in short the efficiency of the propulsion system. The second is the lift/drag ratio of the airplane and the third is its mass-ratio, the ratio between take-off weight and landing weight.

These three quantities concern three different branches of engineering. The first is obviously a problem of power-plant engineering, the second a problem of aerodynamics and the third of structural engineering. Supposing now that

Supersonic flow around corners:
A) shows mild expansion turbulence
B) the flow should cause a self-penetration which is impossible, hence strong shock waves are formed.



the power-plant engineer has produced the best rocket motor he can build, a rocket motor which lasts virtually indefinitely and which gets the highest exhaust velocity out of a given fuel. Supposing that the structural engineer has outdone himself in producing the highest mass-ratio the available materials will allow. What is it that the aerodynamicist can contribute?

One of the best men in the field today, Dr. Theodore von Kármán, made a preliminary investigation of this second quantity of Breguet's formula and came up with a result which does not sound like the answer of an aerodynamicist at all. It was a conclusion which would have sounded natural if it had come from a specialist in external ballistics, either gun or rocket. He found that a very important factor entered the picture, namely: *the weight of the fuselage per square foot of the master cross section.* He called this factor the cross-sectional loading of the fuselage and said:

". . . the value of the resulting drag/lift ratio depends essentially on the ratio between ambient pressure and the cross-sectional loading of the fuselage. In other words, the range of the supersonic airplane can be greatly increased by the reduction of the ambient pressure and by the increase of the cross-sectional loading of the fuselage. Reduction of the ambient pressure means high altitude. Increase of the cross-sectional loading of the fuselage can be accomplished by denser loading, by use of high specific density fuels, and, finally, by the increase of the overall dimensions of the airplane. Obviously the weight increases with the third power and the master cross section with the second power of the linear size. Consequently, the cross-sectional loading of the fuselage, everything else remaining similar, will increase in proportion to the linear dimensions of the airplane." (*Journal of the Aeronautical Sciences,* July 1947, p. 398.)

The people who designed projectiles have always talked about the factor which they called "ballistic cross-sectional load"—now this same factor appears in aerodynamics. And did not one of the early French aviators, Captain F. Ferber de Rue realize the same thing when he wrote in 1911 that the high altitude airplane of the future would have to operate on the principle of the rocket and that it would no longer be a real airplane but rather *un projectile dirigeable?*

The supersonic airplane of the future thus emerges as a winged projectile which is as heavy as possible at take-off and as light as possible on landing. Its fuselage will be as slender as possible but quite long. Its wings will be small. And the plane as a whole will be as large as is compatible with commercial considerations. And it will fly as high as is compatible with the distance to be covered.

Because any kind of engine less

compact than a rocket motor would depress the mass-ratio and would also be an excellent drag and shock wave producer at higher speeds, it will be a pure rocket plane. But take-off help may be considered.

After all, the XS-1 does take off now by means of four very conventional aircraft engines driving propellers. The disadvantage of the mixed power-plant system is caused merely by the desire of having them all in the same airplane. If you separate the planes, the mixed power-plant system may be advantageous after all. Then you would have a "launcher plane" which can be powered with normal engines or jet engines or turboprops and get the rocket airplane up to thirty thousand feet and three hundred fifty m.p.h. The only trouble with this concept is that the rocket plane may grow quite large, which would make the launcher plane even larger and uneconomical if not unmanageable.

But you can provide take-off help by other means, either by a large electrical catapult which would do little more than overcome the original inertia of the plane, or by take-off rockets. The latter brings up the problem of the "elevation" of take-off. Should it be an angle of about 30° which looks logical at first glance or should the method of the "viper" be borrowed and a vertical take-off staged? The German rocket experts have also strongly maintained that a rocket should take off vertically to get out of the dense layers of the atmosphere first and they have maintained that they included rocket airplanes in that statement.

But in a passenger-carrying plane the ideas of the passengers count to some slight, though still noticeable extent. And the passengers might not like the idea of a vertical take-off. In all probability there will be a compromise of some sort, somewhere between thirty and sixty degrees. Much depends on how much of the load of acceleration can be economically handled by the take-off rockets.

That, like many other problems mentioned, plus some that were not mentioned at all, will have to be investigated. For the present we may rest content that there is no longer a brickwall in the sky. No real one and no imagined one.

THE END

* * * * * * * * *

A NEW NATURAL LAW

BY E. L. LOCKE

***One** of the first clues that may lead to an immensely important understanding of gravitational and magnetic fields—and, conceivably, the control of gravity!*

It is a bit too early to be certain, but it does begin to look as if a clue to the long sought link between gravitation and electromagnetism has been found at last. The relationship has not been proved theoretically and the whole argument rests on a numerical observation between some experimental results. However, the reasoning seems awfully plausible and it is being advanced by a man with a fine reputation, Professor P. M. S. Blackett of the University of Manchester.

It all goes back to a question that has been with us a long time indeed, namely, why is the earth a magnet? If you are not a specialist in this field, you will unhesitatingly give the answer you learned in geography class. The earth is a magnet because it is mostly made of iron. This certainly sounds plausible but like so many other easy answers, it is not even approximately true. The trouble with this explanation is that the interior of the earth is pretty hot. In fact, the best information we have today is that from the center to about fifty-five per cent of the earth's radius, the core is in a molten condition. It is also a well-known fact that iron loses its magnetic properties completely at 760° C, a temperature well below its melting point. That settles that.

Of course there has been no lack of other explanations offered. These can be divided into what may be called specific and general theories. A specific theory is one which is based on the specific properties of the matter of which it is composed. A general theory is one that tries to tie up somehow the magnetization with the fact that the earth rotates.

It is interesting to glance at some of the theories that have been offered. An early attempt has been to ascribe the magnetization to dynamo action. It is well known that an electric current sets up a magnetic field. To account for the current, it was assumed that tem-

perature differences inside the fluid core set up thermal electromotive forces. The necessary asymmetry to produce a circulating current was supposed to arise from the existence of Coriolis forces, in a manner analogous to the way they produce a southwest to northwest circulation of air in the Northern Hemisphere. This particular theory did not work because the magnetic field it predicted was far too small. Another theory simply ducked the issue by assuming that aeons ago the field was somehow established and it managed to hang on until now. This theory failed because it can be easily shown that such a field would have decayed too rapidly to be observable now.

The "specific" theories cited above had their origin at a time when it was not yet known that the sun also was a huge magnet. Since no specific theory was successful in explaining the earth's field, with the conditions found in the earth, it was realized that the burden of explaining the sun's field by the same theory would be hopeless. Accordingly investigators started to pay more attention to the problem of finding a "general" theory which would explain both the earth's and the sun's field.

It was in 1891, which, as a matter of fact, antedated the discovery of the sun's field, that Schuster asked the question: "Is every large rotating mass a magnet?" However, his speculations were overlooked until awareness of the sun's field forced theoreticians to abandon hope for a specific theory.

One obvious atomic effect is gyromagnetism. This essentially amounts to saying that an electron circulating in its orbit acts as an electric current and hence it produces magnetization. This theory did not wash because the magnetization was too small by a factor of ten billion.

Another proposal was a sort of a macroscopic gyromagnetic effect. This one assumed that the earth's surface carried a charge of negative electricity and that the interior was charged positively. This latter assumption was necessary because it was known that the net charge of the earth was almost zero. Again, the rotation of the earth made these charges act like an electric current which in turn generated the magnetic field. The only trouble was that the charges had to be of such value that the electric field inside the earth would have amounted to one hundred million volts per centimeter. Insulators this good simply do not exist, especially within the earth.

So far it doesn't look as if the general theory had done any better than the specific one. However, the need for a general theory, a good one that is, received a strong boost when a new discovery was made. The discovery is this: The ratio of magnetic moment to angular momentum was the same for the earth and the sun! (In

atomic physics this would be called the Lande Factor. We will adopt this term for macroscopic bodies.)

Let's back up a bit and explain what the individual terms mean. Imagine a long slender rod pivoted at the center and having equal and opposite magnetic charges concentrated at its tips. Magnetic moment is the name given to the product of the strength of the charge and the length of the rod. This quantity measures the "leverage" effect of a magnet, when another magnet is brought in its vicinity. For bodies of more general shape, having a known distribution of magnetic charges, a more complicated computation can be made which will express this leverage effect as a single number. Thus, in the case of the earth and the sun, we know how the magnetic field varies from the equator to the poles and thus their respective magnetic moments can be calculated.

Angular momentum is a first cousin of momentum as we think of it in connection with say, the motion of an automobile. It is a product of two factors, one being the angular speed, and the other the moment of inertia of the rotating body. For instance a gram of mass at 1 cm. radius has unit moment of inertia, if it were at 2 cms from the axis, it would have 4 units, et cetera. The angular velocity is customarily measured in radians per second; that is, the revolutions per second divided by 2 pi.

Coming back now to the discovery mentioned, we can rephrase it in a physically more significant way, by saying that the magnetic field of the earth or of the sun is proportional to the speed of its rotation. Furthermore when the numbers are expressed in units of magnetic moments and angular momentum, the factor of proportionality is nearly identical for the two bodies.

Now this is an astonishing result, but it leaves one with a feeling that it is too good to be true. After all, there are only two bodies involved and the agreement may be just the result of a coincidence. If there were only a third body which could be measured and a check obtained.

Well, there is such a third body. For the first time in history, the magnetic field of a star has been measured! The star is 78 Virginis and the man who achieved this is H. W. Babcock of Mount Wilson Observatory. Not to keep you in suspense any longer, the Lande Factor, that is, the ratio of magnetic moment to the angular momentum turned out to be almost identical with the value for the earth and the sun!

The magnetic field was determined from the Zeeman effect on the hydrogen lines in the spectrum. The angular momentum could not be measured directly for this particular star, but it was possible to obtain reliable estimates for this spectral class from star tables.

Before going on with a discussion

of the results, consider the following table which sums up the information now available. (It should be noted that a number like 1.12 (49) means 1.12 multiplied by 10 to the 49th power, that is 1 followed by 49 zeros).

Bohr magneton. That is to say, he wants to compute the magnetic moment of an electron spinning in its orbit, then compute the angular momentum and finally their ratio. This number is not hard to calculate, but the details would carry us too far

TABLE

	Earth	Sun	78 Virginis
M, Mass, Gms.	6.0(27)	2.0(33)	4.6(33)
R, Radius, cms.	6.37(8)	6.97(10)	1.4(11)
W, Angular Velocity radians	7.3(-5)	2.9(-6)	7.3(-5)
U, Angular Momentum	7.1(40)	1.12(49)	2.6(51)
H, Polar Field, gauss	.61	53	1500
P, Magnetic Moment	7.9(25)	8.9(33)	2.1(36)
P/U, Lande Factor	1.11(-15)	.79(15)	.81(-15)

The bottom line is the pay off. Notice how closely the Lande Factors agree for the three bodies.

A glance at the table shows that the three measurements span a range of eleven orders of magnitude in angular momentum and in magnetic moment, though the magnetic field varies only by a factor of three thousand or so. Now when data with such an enormous spread in the variables gives such close agreement in the Lande Factor it is necessary to take the theory seriously. Surely we are faced with a new law of nature for all massive rotating bodies.

So far, we are on the solid ground of experiment. Now comes the speculation by which Professor Blackett hopes to tie together gravitation and electromagnetism.

He says, let us compute this factor for a fourth "body", the afield. Suffice it to say that it comes out to be .88(-7).

Now says Blackett, divide the Lande' Factor for the three massive bodies by that for the magneton. The answer is 1.08(-22). This, he then points out is very nearly the same number as the square root of the universal gravitation constant divided by twice the velocity of light!

All this is expressed by the compact formula

$$P = B\, G^{1/2}\, U/2C$$

where G is the aforementioned gravitational constant, C is velocity of light, P is magnetic moment and U is the angular momentum. The quantity B is a number whose value is about ¼. This is an empirical correction. This factor is of no great account as astrophysical calculations go.

Now it might be argued that all this could be a coincidence. Cer-

tainly Blackett admits he has no proof. However, he argues, any theories of magnetization always bring in lots of constants; all of a very special nature. Here there are only two, and they are among the most fundamental known to us. Might there not be more than a coincidence? At the very least it is highly suggestive and should be followed up to see whether or not we have the long sought link between gravitation and electricity.

Whether this pans out or not, the relation between magnetization and spin is on firm ground. What about the possibilities of further tests? Babcock is of the opinion that we should try to get data from the nearly eclipsed edge of the rear component of an eclipsing binary. The Zeeman effect could be used to measure the magnetic field, while the Doppler effect on the wave length of light from different portions of the disk would give direct data on the spin.

As to tests in terrestrial laboratories, the prospects do not seem good just yet. Suppose we used a sphere of as much as ten meters in diameter and spun it at an angular velocity near its bursting strength. This would be about ten revolutions per second. The magnetic field that would result is about one ten-millionth of a gauss. Probably the most sensitive magnetic detector today available is that developed for antisubmarine warfare. This will measure about one-one hundred thousandths of a gauss. Hence we lack a factor of one hundred to try this measurement on earth.

THE END.

IN TIMES TO COME

In addition to Part III of "Players of Ā", the December issue carries a collection of items that are, I think, due to stage a battle-royal contest for places in the Ann Lab. The cover story is "Genius" by Poul Anderson. Has to do with the not-always-predictable results of keeping a planetful of prodigies for pets, imprisoned by lack of equipment and knowledge. . . .

Then there's also "Late Night Final," concerning Earth's conquest and the invading fleet from the dictator's world. (Read that again next month after reading the story and you'll see it's a fair statement!) Russell winds this one up with two small, perfect items. A cuckoo clock and a mail delivery—and those two quite irrelevant items make the story.

H. B. Fyfe has a yarn, "Bureau of Slick Tricks" that's strictly a light-weight gag story, but looks like a fine opening wedge to a series of the same. Fyfe, you may remember, was the first man—some years back—to get himself locked out of his spaceship somewhere between Mars and the asteroids. He has some interesting angles on science-fiction.

THE EDITOR.

BOOK REVIEW

"Strange Ports of Call." Twenty Masterpieces of Science-Fiction. Edited by August Derleth. Pellegrini and Cudahy, New York, 1948, $4.00

This is the most unusual science-fiction anthology to have been published to date.

It is unusual in two important respects. Other anthologies have served to expand each editor's definition of science-fiction. Mr. Derleth disposes of that, and adequately, in the first paragraph of his introduction. This volume is designed to present stories in the field which are good literary writing, and which have good writing's prime requisite, real characters. The other respect in which it is unusual is that it contains only two stories from this magazine.

The reason for this is inherent in the anthologist's very real "feel" for good writing, which is based, apparently, on a classicist's reverence for the gerund and the subjunctive, and horror of zeugma and the contraction in narrative. This is not to say that, with Mr. Derleth, what is pedantic is also good. He has many other values to his scale. One has the feeling, however, that informal narrative, as soon as recognized, has a hard time in making the grade with Mr. Derleth.

The science-fiction addict and the lay reader alike will be deeply grateful to Mr. Derleth for putting into permanent form such treasures as "Mr. Bauer and the Atoms"—Fritz Leiber, Jr.; "Call Him Demon"—Henry Kuttner; "Blunder"—Philip Wylie; and "The Million Year Picnic"—Ray Bradbury. "At the Mountains of Madness" is perfect Lovecraft and, to the uninitiate, a good deal more lucid than much of the master's work. Humor is present in the ingenious "John Jones' Dollar"—Harry Stephen Keeler; and Belknap Long's "A Guest in the House." Also present is the historic s-f "slick" "The Green Hills of Earth"—Robert Heinlein—and a tasty slice each of Dunsany and H. G. Wells.

The inclusion of the weighty Lovecraft short-novel—and let critics not carp: it is first-water, true-blue science-fiction—affords a point of observation which might otherwise be missed in reference to the *raison d'être* of this volume. It would seem that there is still another standard of excellence held by Mr. Derleth: quantitatively, the story's content of the "You Can't Know!" flavor; the feeling of the Something Beyond, the Unknowable. No less than seven of these twenty stories contain this quality—what a jaundiced friend termed "the over-description of the almost-seen." Some of the best of these have it: "Call Him Demon" is, to this eye, a masterpiece in every respect. But there are two stories in the book which appear to have been chosen for this alone; they are "The Thing From Outside"—George Allan England; and "Master of the Asteroids"—Clark Ashton Smith; and one who does not tremble ecstatically at the thought that There Are Forces At Work Which Have No Name will find them unreal if readable.

This seems a pity; both Mr. England and Mr. Smith have turned out superb work.

"The Worm"—Dr. Keller—is a tense experience for the reader. "The Cunning of the Beast," a skilled allegory by Nelson Bond, "The Crystal Bullet"—Donald Wandrei; "The God-Box"—Howard Wandrei; "The Lost Street"—Simak and Jacobi; "Forgotten"—Schuyler Miller; and "Far Centaurus"—A. E. van Vogt—complete the anthology, and each well earns its place in anyone's collection.

THEODORE STURGEON.

THE ANALYTICAL LABORATORY

(*Continued from page 77*)

August, 1948

Place	Story	Author	Points
1.	The Monster	A. E. van Vogt	2.19
2.	Dreadful Sanctuary (End)	Eric Frank Russell	2.31
3.	Time Trap	Charles Harness	2.43
4.	Smaller Than You Think	Kenneth Gray	3.33
5.	Dawn of Nothing	A. Bertram Chandler	4.5

THE EDITOR.

BRASS TACKS

Not "thrown away"—"thrown upon the waters." You'll get that idea coming back in a dozen forms!

Dear Mr. Campbell:

Re May '48 issue.

1) ". . . And Searching Mind"—Williamson has definitely attained his literary maturity with such novels as "Darker Than You Think" and "And Searching Mind." His first major postwar effort is a highly original ingenious and fascinating work although it reveals a faint trace of Heinlein and a large dose of Van Vogt. In fact, I feel that Williamson has outdone Van Vogt at his own avowed specialty—the intricate involved yarn. Williamson presents his Vogtishly complicated tale with a lucidity and command of language that Van Vogt has not matched since "Slan." Williamson's science has developed beyond the geodesic, space warp, and AKKA level too, I'm glad to see. And I don't doubt that Asimov was delighted at the absence of the famous Williamson goddess. I expect to see great things from Williamson in the future especially if *Unknown* returns. It WILL, won't it?
2) "Strange Case Of John Kingman"—another clever Leinster item. I'd characterize Leinster as the editor's best friend: a thoroughly competent, highly original and productive writer.
3) "The Rull"—was a little disappointing although I welcome it as a token that Van Vogt may be on his way back to the comparative simplicity and power of his first dozen yarns.
4) "The Obsolete Weapon"—I quote from page 54: "Out bounded the biggest lion I ever laid my eyes on this side of the Galveston Zoo." Not much of a

compliment to the poor pussy's size, Mr. Hubbard, y'see, Galveston has no zoo. My pardons for assailing your verisimilitude; it makes me feel like that Chevalier sans Illusions, L. S. De Camp.

5) "The Mechanical Answer"—up to the Astounding average.

Enjoyed very much the brief Miller article on "hard cover" fiction. Was amused at references to Williamson as "poor man's Merritt" since Mr. Miller, too, enjoyed a "rep" as Merritt masquerader with such early items as "Cleon of Yzdral," "The Arrhenius Horror," and "The Pool Of Life." That last paragraph of Miller's was alas all too true.

Enjoyed your "Second Solution" article although was as usual disgusted to see you throw the idea away rather than amplify it fictionally as Don Stuart.—Garvin Berry, P.O. Box 633, Galveston, Texas.

Etaoin shurdlu would be more popular than Shelley!

Dear Mr. Campbell:

I would like to read an article, possibly by Willy Ley, on the fascinating subject of Professor Eddington's famous and randomly typewriting apes.

A few exploratory thoughts: given a typewriter with twenty-six letters—ignoring capitals, punctuation and spacing for simplicity's sake—and given a randomly typewriting ape, it is clear that the ape would write the one-letter word "I" on the average of once every thirteen times. Or, given thirteen such apes working on thirteen typewriters, if each took a single punch at the keyboard, the chances would be even that one of them would write the word, "I" with one attempt.

With one hundred sixty-nine—thirteen squared—apes punching just two keys each, successively and randomly, the chances are even that one of them will have written the two-letter word, "It." There is no confusion or mystery so far.

But how long can this sort of thing go on? Does this mean that apes can be substituted for writing geniuses?

No, there are certain practical difficulties.

No matter how many apes you had working, it would be a totally incredible thing, if one of the apes produced a masterpiece of expression such as, "Hail to thee, bright spirit, bird thou never wert—" and so on for a five-hundred-word page of Shelley's collected poems.

The chances may be calculated readily. To get five hundred words or twenty-five hundred letters correct and in the right order, an ape would have to write the two thousand five hundred letters, thirteen raised to the 2500-power times. (This is quite a large number. Compare the weight of all the stars in the known universe expressed in

electrons, which is ten to the fifty-fourth power.) Note that even after this prodigious effort the tired and hungry ape would finish with only an even chance of success or failure.

The mental picture of a team of apes writing an entire page of Shelley after several decillion years of continuous effort, but punching the last letter as a "z" instead of the correct letter is saddening. The single error would put the apes precisely back where they were decillions years ago.

We seem now to be in the realm of fantasy or absurdity. I believe that if every electron in the world were a randomly typing ape and that if the apes were given any number of trials you can imagine, they would never get much further without a mistake than "—bird thou never wert."

The trouble is in the word "randomly." Random typing presupposes hitting the different keys in more or less consistent distribution. Any ape which had an avoidance fixation on the letter "e" for example would never earn his salt on this job. He would never write words containing "e" no matter how many millennia he were to work.

So you have to predicate true randomness. Each letter must have approximately the same chance of being struck as the other twenty-five. But this very proviso will put Shelley's masterpiece forever out of the random ape's reach, because the letter "e" occurs on the average, 13.05 times per hundred, whereas the letter "z" occurs only 0.09 times per hundred. So, if you predicate that no letter is to be slighted unduly, you will only cause the apes to wear out billions of typewriters, because they put in too many "z"s. You cannot write Shelley and employ many "z"s, unless you translate into Polish, which is instinctively ruled out. I do not know the polish equivalent for "Hail to thee, blythe spirit," but whatever it is, it probably does not sound too well.

Of course you might define "randomly" for the present purpose to mean employment of all letters in the approximate frequency of occurrence in English—better yet, Shelley's—poetry, but you would be guilty of quite a bit of fudging, here, and the apes would be hard to train. An ape at a typewriter is instinctively random; so much so that it would be difficult to train him to hit only one key at a time.

But even postulating highly trained apes characterized by this peculiar and skewed randomness, would you ever get an Ode to the Skylark? I, for one, doubt it.

Am I right? Elucidation would be most welcome.—**Paul** Bergen, Box 216, Clearwater, Florida.

Our apologies—we shlipped! It was Timmins.

Dear Mr. Campbell:

I suppose it should be gratifying to see one's name in print, even if

under a "pseudo." But when that name appears in a "by line" over somebody else's work, it has a way of making your face sort of red, and causes you to speculate mildly as to the state of mind of the rightful author. I am referring to the illustrations to the story: "The House Dutiful," by William Tenn, in April A.S.F. which you attribute to one Pat Davis. The truth is that worthy gent had nothing to do with them, and never saw them until they appeared in the mag. I am inclined to suspect our friend Timmins. Whoever it may be, please let him know that I had nothing to do with the stealing of his thunder.—David E. Pattee, Port Washington, Long Island, New York.

I believe the turboencabulator was first developed by the Arthur D. Little Labs—to whom bright credit in a dull technical world is due!

Dear Mr. Campbell:

Have just received the July issue of Astounding and I want to compliment you on the extremely fine cover by Mr. Bonestell. It is certainly the finest cover that Astounding has ever had as far as I am concerned. Would it be possible for me to acquire a larger size suitable for framing? This is not merely my personal opinion but also that of all my friends who are also followers of Astounding—it is marvelous.

For the Analytical Lab:

1. "Dreadful Sanctuary"—I like it.

2. "Burning Bright"—Cartier's illustrations are as excellent as the story itself.

3. "Police Operation"—Good. Plenty of Action. Cartier is still tops.

4. "Decision Illogical"—Good idea but didn't suit me just right.

Your recent timely article on the Endochronic Properties of Resublimated Thiotimoline reminds me of an article I once saw on the operations of the Turboencabulator. It seems this machine operates in the following manner:

The main unit consists of a prefabulated amulite base upon which is a securely bolted stator. The main winding is of the lotus-o-delta type. Adjoining the main winding directly are seven nonreversible tremie pipes which are connected to the grammeters by a high tension girdle spring. The power is transmitted through a spurving bearing to the ambifacient lunar waneshaft—preventing side fumbling quite effectively. The pentametric fan is enclosed in a sturdy malleable logarithmic casing which prevents ambulation of the six hydrocoptic marzel vanes. The forty-one manesticaly spaced grouting brushes are supplied steadily with a high S-value mixture of phenylhydrobenzamine and five percent reminative tetryliodohexamine. The feeding is controlled automatically by two interdodulated metapolar refractive

pilfrometers and three separately coronafied transcental hopper dadoscopes. These instruments effectively control the diathetical evolute of retroactive temperature phase disposition. Thence it transfers through the anhydrous R.F. nangling pines into the kryptonastic bolling shims that are tankered by the anhydrous nangling pines (R.F.). The regurgitative purwell can be nubbed to the supramitive wenel sprocket. The birumogenous sprandrells are maintanindelous inherently. They prevent the frommager from departing from the operating hf rem peak. The inverse reactive power is produced by the medial interaction of magneto reluctance and capacitative directands. The power is then passed through the spiral recommutators by means of the spamshaft and into the gremlin studs which take the large quasipiestic stresses from the roffit bars. From here the power may be transferred to unilateral phase detractors, nofer trunions, bariquescent reciprocating arms, or any other semiboloid type power units.

As I have stated this was read in a magazine and I claim no originality of the Turboencabulator. However, in the light of further scientific discoveries and personal experiments I believe it entirely feasible that re-resublimated thiotimoline could be secured which would have a solubility of from —2.437756854-9987004 seconds to —four and one half days depending on the concentration, solution, weather conditions, et cetera. There is room for further experimentation in this field.—Dale Bainard, 10721 S. Maplewood, Chicago 43, Illinois.

Hm-m-m—he must be off on another time track. 'Fraid it's not THIS November '49.

Dear Mr. Campbell:

I just finished reading my copy of the November issue and I felt compelled to write in and congratulate you. I have no doubts that this issue will rate tops for the year 1949.

The Rogers cover was even better than the best work he did before the war. Ditto with all the other art work; and the whole mag for that matter. I particularly liked the Schneeman pix for the cover story.

Speaking of that cover story, "We Hail": it *was* good. I guess that you really showed everyone that Don A. Stuart can still turn out an A-#1 yarn. I rate it the best in a stiff race. It was good enough not to need a photo-finish however.

For second place, I nominate Anson MacDonald's stanza. "Gulf" was not as good as "Beyond This Horizon" but it was darn good, even for R. A. Mac H. I hope that you hang on to him now that you've got him back again. Let's get on with the *history*.

Third place goes to van Vogt's "Final Command," which was, to my mind, the best short that he has

done since "Vault of the Beast." I still like "Slan" as his absolute best, by the way.

Lester del Rey comes in with a very close fourth. "Over the Top" is even better than his "The Stars Look Down" and that other one about the doctor in the Atomics Works. Del Rey almost nosed van Vogt out but I liked that twist at the end of the A. E. van Vogt story.

How a yarn as enjoyable as "Finished" by an author of de Camp's stature managed to be only fifth choice proves that the competition was keen. Incidentally, how about an article by de Camp?

Theodore Sturgeon is another of my favorites. I genuinely regret that I have to condemn his "What Dead Men Tell" to last place. But even this yarn was way above average. Why don't you have him write another "It"?

Both of the articles rate highly. But then I suspect that most of your readers share my weakness for articles by R. S. Richardson and Willy Ley. Now we all know that the galaxy is full of planets and that magneticity will be running the world in fifty years.

Not content with such a superlative issue you added the icing on the cake with your announcement in the "Times to Come" department that January would see the first installment of Dr. Edward E. Smith's latest epic. A new series, eh? Hm-m-m, you intrigue me no end. I wonder what the good doctor has dreamed up this time. I look forward in anticipation. Vive le Smith; despite all of his detractors he still towers head and shoulders above most of his fellows.

I would also like to put in my two cents worth concerning the matter of size. I favor your switch back to the Annual size. A. Science Fiction has improved steadily since you re-enlarged it.

There is another point: About eleven years ago you sold some of your cover paintings for ten dollars each to the first writers in. How about a repeat on this? I would be tickled pink to own one. I am afraid that ninety percent of your readers will feel the same.

Before I close, I would like to offer you my congratulations upon the splendid job you are doing with ASF sister magazine. You have more than restored it to its old standing. I'm happy, also, to see that you've gone back to the plain *Unknown* instead of *Unknown Worlds*.—Richard A. Hoen, The University Club, 546 Delaware Avenue, Buffalo 2, New York.

Think of all the vitamin pill business those bugs could ruin!

Dear Mr. Campbell:

Re: Biosynthesis of Vitamins.

Mr. M. Diner in the July session of Brass Tacks referred to a recent British investigation on thiamin

which led to the findings that thiamin is produced in the human intestinal tract. Now with due regard to the hands-across-the-border-spirit I must submit that two American medicos V. A. Najjar and L. E. Holt, of John Hopkins University, reported in 1943 on "The Biosynthesis of Thiamin in Man. And Its Implications in Human Nutrition." These men fed a synthetic diet to nine young adult males. The thiamin content was gradually diminished until entirely withdrawn. Later four subjects showed definite signs of thiamin deficiency while four others appeared normal. A large amount of thiamin was found in the feces of the healthy boys while very little was found in the stools of the sick. When the sulfa-drug succinyl sulfathiazole was given by mouth to the healthy men no thiamin was found in their feces. On stopping the sulfa-drug, the thiamin reappeared. So it seems the British investigators mentioned by Mr. Diner merely confirmed the work of the Americans.

In 1944, Najjar, Holt, and others reported on the biosynthesis of riboflavin in man. Here again, micro-organisms seemed to be at work. The riboflavin found in the stools was five to six times the intake. The sulfa-drug had no effect on the biosynthesis of the riboflavin. Similarly in 1946, V. A. Najjar and others found indications of the biosynthesis of niacin and that the sulfa-drug had no detrimental effect. However, C. W. Denko and others, of the ASF Medical Nutritional Lab. in Chicago, reported in 1946 that on using a normal diet instead of a synthetic one, the excretion of thiamine, riboflavin, niacin, and pyridoxine did not exceed the intake. This would seem to contradict the work of Najjar and his collaborators but one must bear in mind there was a difference in the nature of the diets. Diet may be an important factor; for W. A. Krehl and others have shown experimentally that the need for niacin apparently varies with the content of tryptophane, an amino acid, in the diet. Therefore investigators will not only try to isolate and identify the micro-organisms responsible for biosynthesis of the B-vitamins in man but also they will try to determine what dietary elements such as amino acids, carbohydrates, minerals, etcetera are most favorable for the growth of the isolated bacteria. The prospects around the corner are more in the nature of combining suitable diet and micro-organisms and not merely the implanting of the vitaminogenic bacteria in the human intestine. Another point to remember is that the above knowledge extends only to the B-vitamins and possibly vitamin K. The fat soluble vitamins and vitamin C are yet to be found the products of human biasynthesis.

In closing, we must salute the British for learning that beer is a good source of niacin. *Prosit!*—Charles Zahn, 1421 Arch Street, Philadelphia, Pennsylvania.

THE PLAYERS OF Ā

BY A. E. VAN VOGT

Part II of IV. *The great trouble that had overwhelmed Earth and Venus had been but a minor border incident. Now the Great War of two Galactic Empires was rising to its full fury—*

Illustrated by Rogers

Non-aristotelian Venus was saved from conquest by the fortitude of its semantically trained inhabitants, and by the extra brain of Gilbert Gosseyn. After the defeat of the galactic forces that attacked the solar system, as chronicled in "The World Of Ā"—August, September, October, 1945. Astounding Science Fiction; Simon and Schuster, 1948—Gosseyn discovers that the Follower, a being who seems to be made of shadow substance, has developed a sinister interest in him.

As a result he is prevented from reaching Venus until after Eldred Crang and Patricia Hardie have departed from the no longer secret —now abandoned—galactic base of the Greatest Empire on Venus. Crang and Patricia depart because they are in hourly danger of being cut off from the nearest galactic base, which means that no one will be able to leave the solar system. They hope to rescue Gosseyn.

Gosseyn realizes that months may pass before he is taken off the isolated solar system. He feels frustrated because in playing over a recording of a conversation between Crang and Patricia, he discovers that the war between Enro and the League has started, and that a gigantic interstellar battle is being fought in the Sixth Decant near the center of the galaxy.

He finds that the Venusian base is still linked to the interstellar telephone exchange, and so he has a talk with Madrisol, secretary general of the galactic league. But Madrisol cannot come to the aid of Venus.

Later, Gosseyn learns that Patricia Hardie is the sister of Enro the Red, warlord of the Greatest Empire.

He manages to trace an agent of the mysterious Follower, and learns for the first time that the shadow-being has predicted his moves with a clocklike accuracy as much as two weeks in advance.

This is Gosseyn's first knowledge that there are people in the galaxy who can foretell the future.

Having confronted the Follower's agent, he is still in process of gaining information from the man when he discovers that he is caught in a trap that the Follower has set for him.

The trap involves "instantaneous" transport by similarity means of his body to the planet Valerta, where the Predictors live. He lies unconscious in a concrete, doorless prison for several days. His loss of consciousness amazes the Follower, for it was not a part of his plan.

What has happened is that Gosseyn's mind has been somehow "transformed" by another "player" into the body of the Prince Ashargin, deposed heir of the one time ruling family of the Greatest Empire. He finds himself in control of the prince's body just as the latter is being taken to the palace fortress of Enro the Red on the planet of Gorgzid. Enro has his own reasons for having kept the weakling Ashargin alive. He plans to use him to further his own grandiose schemes for galactic power, to attain which he has already launched the battle of the Sixth Decant.

To Enro's surprise, the prince—controlled by Gosseyn—does not act quite as expected. However, Gosseyn has his own troubles with the unbalanced—it was deliberately done by Enro—prince. He realizes he must first give the young man semantic training and readjustment.

Before he can do anything, Enro sends him by Distorter transport to the flagship of Grand Admiral Paleol, commander of the hundreds of thousands of warships fighting the decisive battle of the Sixth Decant.

Gosseyn's "mind" at this point is returned to his own body. He finds himself in the prison cell of the Follower's Retreat. *Two other people, a huge man named Jurig and a Predictor woman named Leej, occupy cells separated from each other and from his by needle-stud-*

ded metal grilles. For the first time Gosseyn learns that Valeria is the home planet of the Predictors, that it is isolated from the rest of the galaxy like Earth and Venus, but that Predictor men and women are being impressed into the service of Enro for war purposes. Gosseyn has his first picture of a battle fought with the help of people who can foretell every move of the enemy. He realizes, that unless some method is discovered to counteract the prophecies, Enro will win the great galactic war.

He learns that whenever he uses his extra brain his own future cannot be foretold.

He is still in the process of interviewing Leej when the grilles separating the cells begin to lift. The time has come for Jurig to obey the Follower's orders and kill Gosseyn.

PART 2

VII.

Abstracts

In making a statement about an object or an event, an individual "abstracts" only a few of its characteristics. If he says, "That chair is brown!" he should mean that brownness is one of its qualities, and he should be aware, as he speaks, that it has many other qualities. "Consciousness of abstracting" constitutes one of the main differences between a person who is semantically trained and one who is not.

With the speed of a hunting cat, Gosseyn was off his cot. His fingers gripped the crossbar of the grille at the bottom. He felt himself irresistibly lifted up.

The effort to hold on cost him every ounce of strength in his arms and fingers. The area to which he had to cling was less than an inch in thickness, and it curved the wrong way. But he had taken his grip just under the needles, under that fantastic pattern of needles, and he either hung on or suffered ultimate defeat.

He hung on. As he came up above the level of the window, he was able to see out. He had a glimpse of a courtyard in the immediate foreground, of a high fence in the near distance made of sharp pointed metal spears, and of a land of trees beyond. Gosseyn barely glanced at the vista. One look at the scene as a whole, and then he turned his attention to the courtyard.

There was an agonizingly slow moment while he "memorized" the surface structure of a part of a cobblestone. And then, his purpose accomplished, he dropped nearly twenty feet to the cement floor of the cell.

He landed on all fours, physically relaxed, but with his mind as taut as a metal bar. He had an outside area to which he could escape by using the special powers of

his extra brain, but he still had to make up his mind what his immediate course of action should be.

His problem with regard to the Follower was not radically altered. Deadly and imminent danger remained. But at least he could now get out into the open.

Warily, like a fighter parrying a dangerous opponent, Gosseyn watched the gorillalike Jurig who was supposed to kill him.

"Leej," he said, without looking at the Predictor woman, "come over here behind me."

She came without a word, her feet almost noiseless on the floor. He had a glimpse of her face as she slipped past him. Her cheeks were colorless, her eyes blurred, but she held her head high. From the far side of what was now one room, Jurig snarled:

"That won't do you any good, hiding behind him."

It was a purely thalamic threat, serving no useful purpose even to Jurig. But Gosseyn did not let it go by. He had been waiting for an opening. A man who could not make up his mind about a larger issue had to appear to concentrate on a smaller one. So long as he gave the impression of being concerned with Jurig, as if *that* was the danger, just so long would the Follower await events. He said in a steely voice:

"Jurig, I'm tired of that kind of talk. It's time you made up your mind whose side you're on. And I'm telling you right now that it had better be mine."

The Yalertan, who had been bracing himself and edging forward, stopped. The muscles of his face worked spasmodically, quivering between doubt and rage. He glared at Gosseyn with the baffled eyes of a bully whose smaller opponent was not afraid.

"I'm going to smash your head against the cement," he said from between clenched teeth. But he spoke the words as if he were testing their effect.

"Leej," said Gosseyn.

"Yes?"

"Can you see what I'm going to do?"

"There's nothing. Nothing."

It was Gosseyn's turn to be baffled. True, if she couldn't foresee his actions, then neither could the Follower. But he had hoped to obtain a vague picture which would help him make up his mind. What should he do when he got outside? Run? Or enter the *Retreat* and seek out the Follower?

His role in this affair was on a vaster level than that of either Jurig or Leej. Like the Follower, he was a major piece in the galactic game of chess. At least, he must consider himself one until events proved otherwise. It imposed restraints upon him. Escape alone would not solve his problems. He must also, if it could possibly be done, plant the seeds of future victory.

"Jurig," he temporized aloud, "you've got a big decision to make. It involves more courage than you've yet shown, but I'm sure you have it in you. From now on, regardless of consequences, you're against the Follower. I tell you, you have no choice. The next time we meet, if you're not working unconditionally against him, I shall kill you."

Jurig stared at him uncertainly. It seemed hard for him to realize that a fellow prisoner was actually giving him an order. He laughed uneasily. And then the immensity of the insult must have penetrated. He became enormously angry, the anger of a man who feels himself outraged.

"I'll show you what choice I have!" he shouted. And launched himself.

His approach was swift but heavy. He held his arms out, obviously intending to hug and squeeze, and the surprise for him was when Gosseyn stepped right into the circle of those bearlike limbs, and sent a powerful right to his jaw. The blow failed to land squarely but it stopped Jurig short. He grappled Gosseyn with a sick look on his face. His expression grew sicker as he fought to gain a stranglehold on a man who, now that so telling a blow had been struck, was not only faster but stronger than himself.

The Yalertan yielded suddenly, like a door that has been smashed open with a battering ram. Gosseyn felt it coming, and with a final burst of strength sent the other staggering back across the floor, routed, defeated in mind and body.

The shock would be lasting, and Gosseyn regretted it. But there was no doubt that it had been necessary. On such identifications, people like Jurig built their egos. All through his life, like the goats in the famous experiment, Jurig had butted his way to dominance. It was his way, not Gosseyn's, of expressing his superiority.

Consciously, he would resent the defeat, find a dozen excuses for himself. But on the unconscious level he would accept it. So far as Gilbert Gosseyn was concerned, his confidence in his physical prowess was gone. Only A training would ever enable him to reorientate himself to the new situation, and that was not available.

Satisfied, Gosseyn "similarized" himself out onto the courtyard. Swiftly, then, the greater purpose of escape took full possession of his nervous system.

He was vaguely aware of people in the courtyard turning to look at him as he ran. He had a glimpse, in turning his head, of an enormous pile of buildings, spires and steeples, masses of stone and marble, colored glass windows. That picture of the Follower's *Retreat* remained in his mind even as he kept "watch" on every energy source in the castle. He was ready to "similarize" him-

self back and forth to escape blasters and power-driven weapons. But there was no change in the flow from the dynamo or the atomic pile.

Automatically, he "similarized" Leej to the "memorized" area behind him, but he did not look to see if she was following him.

He reached the tall fence, and saw that the spears which looked formidable enough in themselves were encrusted with the same kind of needles as had been the grilles in the prison cell he'd just left. Nine feet of unsealable metal—but he could see between the spears.

It required the usual long—it seemed long—moment to "memorize" an area beyond the fence. Actually, it was not a memory. When he concentrated in a definite fashion on a spot, his extra brain automatically took a "photograph" of the entire atomic structure of the matter involved to a depth of several molecules. The "similarization" process that could then follow resulted from the flow of nervous energy along channels in the extra brain—channels which had been created only after prolonged training. The activating cue would send a wash of that energy out, first of all along the nerves of his body, and then beyond his skin. For an instant then, every affected atom was forced into a blurred resemblance to the "photographed" pattern. When the approximation of similarity was made accurate to twenty decimal places, the two objects became contiguous, and the greater bridged the gap to the lesser as if there was no gap.

Gosseyn "similarized" himself through the fence and started to run toward the woods. Started. He felt the presence of magnetic energy and saw the plane glide toward him over the trees. He kept on running, watching it from the corner of his eyes, striving to analyze its power source. It had no propeller, but there were long metal struts jutting down from its stubby wings. Similar type plates ran along its fuselage—and that gave him confirmation. Here was the source of the magnetic power.

Its weapons would be bullets or a magnetic beam blaster.

The machine had been off to one side. Now, its nose twisted toward him. Gosseyn "similarized" himself back to the fence.

A plume of colored fire puffed along the ground where he had been. The grass smoked. There were flashes of yellow flame from the brush, but that only mingled with the red-green-blue-orange of the blaster's own chromatic display.

As the plane hissed past him, Gosseyn took a "photograph" of its tail assembly. And once more, at top speed, he started to run toward the trees more than a hundred yards away.

He kept a watch on the plane, and saw it turn and dive down at him again. This time Gosseyn took no chances. He was a hundred feet from the fence, which was danger-

ously close. But he "similarized" the tail assembly of the plane to the "memorized" area beside the fence.

There was a crash that rocked the ground. The metallic shriek of the plane, its speed undiminished by the process of similarization, was earsplitting as it screeched along parallel to the fence, tearing the fence with fantastic ripping sounds. It came to a rest an eighth of a mile away itself a tattered fragment.

. . . . .

Gosseyn ran on. He reached the woods safely, but he was no longer satisfied with merely escaping. If one attacking device existed, then so might others. Swiftly, he "memorized" an area beside a tree, stepped aside and brought Leej up to it. Next, he transported himself back to the area just outside the cell window, and headed at a run for the nearest door leading into the *Retreat*. He wanted weapons that would match anything the Follower had mustered to prevent his escape, and he intended to get them.

He found himself in a broad corridor, and the first thing he saw was a long line of magnetic lights. He "memorized" the nearest one, and immediately felt a lot better. He had a small but potent weapon that would operate anywhere on Yalerta.

He continued along the corridor but no longer at top speed. The dynamo and the pile were near, but just where he had no way of knowing. He sensed the presence of human beings around, but the neural flow was neither tense nor menacing. He came to a basement stairway, and without hesitation headed down the long flight of steps. Two men were standing at the bottom, talking to each other earnestly but without anxiety.

They looked up at him in surprise. And Gosseyn, who had already made his plan, said breathlessly: "Which way to the power plant? It's urgent."

One of the men looked excited. "Why . . . why—that way. That way. What's the matter?"

Gosseyn was already racing in the direction indicated. The other called after him, "The fifth door to your right."

When he came to the fifth door, he stopped just inside the threshold. Just what he had expected he didn't know, but not an atomic pile feeding power *to* an electric dynamo. The huge dynamo was turning softly. Its great wheel glinted as it moved slowly. To either side were walls lined with instrument boards. A half dozen men were moving around, and at first they didn't see him. Gosseyn walked boldly towards the power outlet of the dynamo, and "memorized" it. He estimated it at forty thousand kilowatts.

Then, still without hesitation, he strode to the pile itself. There were the usual devices for looking into the interior, and an attendant was bending over a gauge making minute adjustments on a marked dial. Gosseyn stepped up beside

him, and peered through one of the viewing devices into the pile itself.

He was aware of the man straightening. But the long moment the other required to grasp the nature of the intrusion was all that Gosseyn needed. As the attendant tugged at his shoulder, too surprised for speech or anger, Gosseyn stepped back and, without a word, walked to the door and out into the corridor.

The moment he was out of sight, he transported himself into the woods. Leej stood a dozen feet away, almost facing him.

She jumped as he appeared, and babbled something he didn't catch. He waited for the expression on her face to indicate that she was recovering. He didn't have long to wait.

Her body trembled, but it was a quaver of excitement. Her eyes were slightly glazed, but they became bright with eagerness. She grabbed his arm with quivering fingers.

"Quick," she said, "this way. My trailer will be over here."

"Your what?" said Gosseyn.

But she had started off through the brush, and she seemed not to hear.

Gosseyn ran after her, his eyes narrowed; and he was thinking: *Has she been fooling me? Has she known all this time that she was going to-escape now? But then why wouldn't the Follower know, and be waiting?*

He couldn't help remembering that he was caught in "the most intricate trap ever devised for one man." It was something to think about even if he apparently succeeded in getting away.

Ahead of him, the woman plunged through a screen of tall shrubs, and then he didn't hear her any more. Following her, Gosseyn found himself on the edge of a limitless sea. He had time to remember that this was a planet of vast oceans broken at intervals by islands, and then an airship came floating over the trees to his left. It was about a hundred and fifty feet long, snub-nosed, and about thirty feet high at its thickest. It plunged lightly into the water in front of them. A long, sleek gangplank came sliding down toward them. It touched the sand at the woman's feet.

In a flash, she was up and along it. She called over her shoulder. "Hurry!"

Gosseyn pressed across the threshold behind her. The moment he was inside, the door flowed shut, and the machine began to glide forward and up. The swiftness with which everything happened reminded him of a similar experience he'd had at the Temple of the Sleeping God on Gorgzid while in the body of Prince Ashargin.

There was one difference, vital and urgent. As Ashargin, he had not felt immediately threatened. Now, he did.

VIII.

Abstracts

Aristotle's formulations of the science of his time were probably the most accurate available during his lifetime. His followers for two thousand years subscribed to the identification that they were true for all time. In more recent years, new systems of measurement disproved many of these "truths," but they continue to be the basis of the opinions and beliefs of most people. The two-valued logic on which such folk thought is founded has accordingly been given the designation aristotelian—abbreviation: A—and the many-valued logic of modern science has been given the name non-aristotelian—abbreviation: Ā, null-A.

Gosseyn found himself in a corridor at the bottom of a flight of steps. The corridor extended both right and left, curving gradually out of sight. At the moment he had no impulse for exploration. He followed Leej up the stairway toward a bright room, and he was already noticing the radical design of the ceiling lights. It confirmed his first "feel" of the ship's power source. Magnetic power.

The fact was interesting because of the picture it gave him of Yalertan scientific development, comparable to twenty-second century Earth. But it also gave him a shock. For him now the magnetic engine

had a flaw. It was too complete. It performed so many functions that people who used it had a tendency to discard all other forms of power.

The Predictors had made the old mistake. There was no atomic power aboard. No electricity. Not even a battery. That meant no really potent weapons, and no radar. These Predictors obviously expected to be able to foresee the approach of anything inimical to them. Which was not so any more. He had a vision in his mind of galactic engineers sending electrically guided aerial torpedoes with proximity fuses and atomic warheads, or any of a dozen devices that, once attuned to a target, would follow it till they destroyed it or were themselves destroyed.

The worst part of it was that he could do nothing but find out as swiftly as possible just how much Leej could foresee.

And of course, he could hope.

The bright room into which Leej led him was longer, broader and higher than it had seemed from the entrance below. It was a drawing room, complete with couches, chairs, tables, a massive green rug—and, directly across from where he had paused, a sloping window that bulged out like a streamlined balcony from the side of the ship.

The woman flung herself with an audible sigh onto a couch near the window, and said: "It's wonderful to be safe again." She shook her dark hair with a tiny shudder. "What a nightmare."

She added in a savage tone, "That will never happen again."

Gosseyn, heading for the window, was stopped short by her words. He half turned to ask her on what she based her confidence. He didn't speak the question. She had already admitted that she couldn't foretell the actions of the Follower, and that was all he needed to know. Deprived of her gift, she was a good-looking, emotional young woman about thirty years old without any particular astuteness to protect her from danger. He could find out all she knew after he had done what *he* could to ward off possible attacks.

As he started forward again, he felt the nerve sensation that indicated the approach of a human being. A moment later, a man emerged from a door that led to the forward part of the vessel. The fellow was slim, with an edge of gray in his hair. He ran over to Leej, and knelt beside her.

"My dear," he said, "you're back."

He kissed her with a quick movement of his body and head.

At the window now, Gosseyn ignored the lovers. He was looking down and back at a fascinating scene. An island. A green island, set like an emerald in a sapphire sea. There was a gem within the green gem, a pile of buildings that shone gray-white in the sun, and already it was hard to make out the

details. They seemed unreal, and actually did not resemble buildings at this distance. His knowledge that they were enabled his mind to fill in the gaps.

The ship was climbing a long, shallow slope of air. Its speed was evidently greater than he had thought from the smoothness of the acceleration. Because, as he watched, the island shrank visibly in size. And he could see now that there was no apparent movement either on the ground or in the air above it.

That braced him, though there had been in his mind through all the dangerous moments the knowledge that, even if he were killed, the continuity of his memories and thoughts would immediately be carried on by another Gosseyn body, which would wake up automatically in a remote hiding place.

Unfortunately, as he had learned from an earlier version of his body, now dead, the next group of Gosseyns was eighteen years old. He couldn't escape the conviction that no eighteen year old could handle the crisis that had been created by Enro. People had confidence in mature men and not in children. That confidence might make a difference between victory and defeat in a critical moment.

It was important that he remain alive in this body.

His eyes narrowed thoughtfully as he considered the immediate possibilities. He had work to do. He must stop further transportation of Predictors to Enro's fleet, seize the warship that had landed, and, as soon as possible, attack the shadow-thing on his island.

There were preliminaries to be accomplished, but those were the things he must work toward—and swiftly. Swiftly. For the great and decisive battle of the Sixth Decant was hourly growing in fury. If he knew anything of human nature, then the League was already shaken to its tenuous foundations. Certainly, Enro expected it to collapse. And, childish though the dictator might be when it came to women, on political and military level, he was a genius.

He was about to turn from the window when it struck him that Jurig, under sentence of death as he was, might be bearing the brunt of the Follower's wrath. Hastily, he "similarized" Jurig to the woods outside the fence. If the man was at all afraid, he would hide there and so be available for transportation to the ship later on.

The action taken, he twisted back into the room in time to hear the woman say calmly:

"I'm sorry, Yanar, but he will want a woman, and naturally I must be the one. Good-by."

The man was on his feet, his face dark. He looked up and his eyes met Gosseyn's. The hatred that sparkled in their dark depths was matched by the sensation that jumped from his nervous system to

Gosseyn's extra brain. He said with a sneer:

"I don't give my mistress up to anyone without a fight, even someone whose future is a blur."

His hand disappeared into a pocket, and came out with a small, fanlike instrument. He brought it up, and pressed the "charger."

Gosseyn walked forward, and took the weapon from Yanar's fingers. The other did not resist. There was a strained look on his face, and the nervous rhythm that exuded from him had altered to a fear pattern. He was obviously stunned at the way his fragile appearing but powerful gun had failed to "fire." Gosseyn moved off several paces and examined the instrument curiously. The radial flanges that made up the antenna was typical, and verified, if verification was needed, the nature of the energy involved. Magnetic weapons operated on outside power, in this case the field set up by the magnetic engines in the hull. The field extended with dimming strength for a distance of nearly five miles beyond the hull.

Gosseyn slipped the instrument into his pocket, and tried to imagine the effect on Yanar of what had happened. He had "photographed" the entire weapon, and allowed one of the discharge points to flow to a "similarized" area into the prison cell of the Follower's *Retreat.* The distance in space prevented the current from coming back to the ship; and so the weapon, its energy diverted, had failed to function. The psychological effect must be slightly terrific.

The man's face remained a bleached white, but he brought his teeth together with a snap.

"You'll have to kill me," he said, bitterly.

He was a middle-aged nonentity, set in his ways, thalamically bound up in A—as distinct from Ā—habits, and because he could shoot for purely emotional reasons, he would be dangerous so long as they were both aboard the ship. He must be killed, or exiled, or—Gosseyn smiled grimly—guarded. He knew just the man who could do it. Jurig. But that was for later. Now, he half-turned to Leej, and questioned her pointedly about the marriage customs of the Predictors.

There was no marriage. "That," said Leej with disdain, "is for the lesser breeds."

She did not say so in so many words, but Gosseyn gathered that Yanar was one of a long line of lovers, and that, being older, he had had even more mistresses. These people wearied of each other, and because of their gift were usually able to name the exact hour when they would separate. The unexpected appearance of Gosseyn had terminated this affair sooner than anticipated.

Gosseyn was neither repelled nor attracted by the *mores* involved. His first thought had been to reassure Yanar that he needn't worry about losing his mistress. He didn't

say it. He wanted a Predictor beside him from now on, and Leej might be insulted if she discovered that he did not make love to women who did not have some A training.

He asked Leej one more question. "What does Yanar do besides eat and sleep?"

"He runs the ship."

Gosseyn motioned at Yanar. "Lead the way," he said curtly.

Further conversation with Leej could wait. He was a man who must depend on what *he* knew, and the sense of urgency was strong upon him again.

As he examined the ship, Gosseyn's mind jumped back to what Leej had said when they were running through the underbrush on the Follower's island. Trailer, she had called her machine.

A skytrailer. He could imagine the easy life these Predictors had lived for so many years on their world of islands and water. Floating lazily through the sky, landing when the mood touched them, and where they desired; seizing control of any "lesser" human being whom it pleased them to enslave, and snatching any object they wanted to possess—there was a part of man's nature that longed for such a carefree existence. The fact that in this case it included a ruthless subjugation of people who did not have the precious gift of prophecy was easy to understand also. Overlordship could always be justified by minds that were not too critical. And, besides, recent generations had grown up from babyhood in an environment where slavery was not questioned by the Predictor hierarchy. The attitude was part of the "set" of their nervous systems.

Though they did not seem to realize it, the appearance of the Follower on their idyllic scene had forever broken the casual pattern of their existence. And now, the arrival of the galactic warship and the presence of Gilbert Gosseyn were further indicators of their changing condition. They must either adjust or be swept aside.

The control room was in the nose of the vessel. It didn't take long to examine it. The controls were of the simple "discharger" type common to energy derived from the planet's own magnetic currents.

The dome of the control room was limpidly transparent. Gosseyn stood for a long moment gazing down at the sea that was rushing by below. As far as he could see ahead there was only a mass of heaving waters, and not a sign of land.

He turned away to continue his exploration. There was a steel stairway in one corner. It led up at a steep slant to a closed hatch in the ceiling. Gosseyn started up immediately.

The loft turned out to be a storeroom. Gosseyn examined the labels on boxes and containers, not quite sure what he was looking for, but ready to follow up on any idea that suggested itself. Suddenly, as he

examined a drum filled with de-gravitized air, the idea came.

As he continued his conducted tour, his plan grew more plausible. He glanced in at each of four bedrooms, a dining room, and a rear control room on the main floor, and then went down to the lower "deck," but by now he was searching for something. He had previously sensed the presence of other human beings below deck. He finally counted six men and six women. They were submissive in manner, and judging from the neural flow from their bodies, obviously accepted their lot. He dismissed them from his calculations and, after peering in at spacious kitchens and more storerooms, he came to a workroom.

It was what he had been looking for. He sent Yanar about his business, and locked the door.

Gosseyn emerged three hours later with two tubes set up on a plate that would take power from the magnetic field of the ship's engines. Straight up to the loft he climbed, and spent more than fifteen minutes piping de-gravitated air into the air-tight container inside which he had set up his tubes.

At first the oscillation was faint. It grew stronger. The rhythmic pulse beat in his extra brain steadily and evenly. On earth, the graviton tube was known as a member of a group that was said to possess "radiation hunger." Lacking the gravitonic particle, it craved stability. Up to that point its reactions were normal. For all things in nature fought constantly to achieve a balance. It was the tube's methods that were fantastic.

It sent out radiations of its own to *search* for normal matter. Every time it touched an object, a message was dispatched back to the tube. Result: excitement. A change in the rhythm so long as the object remained in the vicinity. On Earth technicians said of such moments, "There's old Ehrenhaft wagging his tail again."

Not that it did any good. And the tube never seemed to learn from experience. The process went on and on, without its hunger ever being satisfied. Surprisingly, as with many other things, such stupidity was useful to those who cared to exploit it.

Gosseyn maneuvered the ship to a height of five miles, and then down almost to the surface of the water. He was able in this way to accustom himself to the normal rhythm variation of movement above a sea. Finally, he set the cue. If there was any variation in the rhythm, then his extra brain would be warned, whereupon he would "similarize" himself into either front or rear control room and decide on further measures.

It was a personal detector system on a very limited level, useless against weapons traveling miles a second, and certainly useless if a galactic Distorter ever got a "fix" on his ship. But it was something.

Gosseyn hesitated, then found himself an end of wire and "memorized" it. Quickly he "memorized" two floor areas in the control room. And then, as the sun disappeared behind the shimmering horizon of water, and the twilight quickened toward night, he headed for the living room conscious that he was ready for more positive action.

When Gosseyn entered the living room, Yanar was sitting in a chair near the window, reading a book. The room glowed with soft, magnetic lights. Cold lights, yet they always looked so warm and intimate, because of the way their colors changed ever so little from moment to moment.

Gosseyn stopped just inside the doorway, and watched the other narrowly. This was the test. He "similarized" the wire end back in the control room to the first "memorized" area. And waited.

The older man looked up with a start from his book. He stared at Gosseyn grimly, then climbed to his feet, walked to a chair at the far end of the room, and sat down. A steady stream of unfriendly neural sensations, tinged with spasmodic discharges indicating doubt, flowed from the Predictor's nervous system.

Gosseyn studied the man, convinced that he had got as much of a response as he could hope for. It could be an attempt to fool him. His every move could have been foreseen and allowed for. But he thought not.

Accordingly, his major problem with these Predictors was solved. He could carry on an interview, and be fairly sure that his questions were not being anticipated. There was one more problem. Should he or should he not be conciliatory with Yanar?

That was more important than it might seem. It took time to make friends, but it only required a shock moment to impress another person with the fear that he was in the presence of a superior. The power of Gilbert Gosseyn on Yalerta was going to depend on his ability to put over the idea that he was invincible. In no other way could he hope to operate at the top speed necessary to his plans and to the basic war situation in the galaxy.

The question was, at what speed would it be right for him to operate?

Gosseyn walked over to the window. It was almost pitch dark now, but the glint of the sea was visible in the half light. If there was a moon circling the planet, it was not yet above the horizon, or else it was too small to reflect a noticeable amount of sunlight.

He gazed at the light-flecked waters, and wondered how far he was from Earth. It seemed strange, even unsettling, to realize how great the distance must be. It brought a sense of smallness, an awareness of how much remained to be done. He could only hope he would be able to develop to the height of power

that would be necessary in the critical days ahead. He was not a man who need ever think of himself as belonging to any one planet. But still, he did have a strong feeling for the solar system.

A sound drew his attention. He turned away from the window, and saw that the slaves from the lower deck were busy in the dining room. He watched them thoughtfully, noting that the youngest and prettiest girl was the target for little, spiteful acts of domination by the other two women. She was about nineteen, Gosseyn estimated. She kept her eyes down, which was a significant sign. If he knew anything about thalamic people—and he did—then she was biding her time and awaiting an opportunity to repay her tormentors. Gosseyn guessed from the nature of the neural sensations that flowed from her that she would be able to do her greatest damage by playing the coquette with the men servants.

He studied Yanar again, and made up his mind. Definitely, irrevocably, no friendliness.

He walked slowly toward the man, making no effort to be stealthy. The Predictor glanced up, and saw him coming. He stirred uneasily in his chair, but remained where he was. He looked unhappy.

Gosseyn considered that a good sign. Except for those who had been in contact with the Follower, none of these Predictors had ever been subjected to the pressure of not knowing from instant to instant what the future might hold. It should be interesting to observe the effect on Yanar. And besides he himself needed information badly.

Gosseyn began by asking the simple questions. And before each one—not only in the beginning, but during the entire interview—he shifted the wire in the control room back and forth between the floor areas "1" and "2."

With occasional exceptions, Yanar answered freely. His full name was Yanar Wilvry Blove, he was forty-four years old, and had no occupation—that was where the first hesitation came.

Gosseyn noted the point mentally, but made no comment. Blockage in connection with occupation, distinct interruption in neural flow.

"Is there any significance to your names?" he asked.

Yanar seemed relieved. He shrugged. "I'm Yanar of the Wilvry birth center on the island of Blove."

So that was how it worked. He shifted the wire again, and said affably: "You people have quite a gift of foreseeing. I've never run into anything like it before."

"No good against you," said Yanar darkly.

That was worth knowing for sure, though, of course, the statement that it was not usable did not make the words true. Fortunately, he had other verification.

Not that he had any alternative

but to proceed as if Yanar didn't foresee his questions.

The interview continued. Gosseyn wasn't sure what he was searching for. A clue perhaps. His belief that he was still in the Follower's trap was becoming greater and not less. If that was so, then he was fighting against time, in a very real sense.

But what was the nature of the trap?

He learned the Predictors were born in a normal fashion, usually aboard skytrailers. A few days after being born they were taken to the nearest birth center that had space available.

"What does the birth center do to the child?" Gosseyn asked.

Yanar shook his head. And there was blockage again in the neural flow from him. "We don't give information like that to strangers," he said stubbornly, "not even to—" He stopped, shrugged, then finished curtly, "To no one."

Gosseyn did not press the matter. He was beginning to feel distracted. The facts he was unearthing were valuable but not vital. They did not fit his needs of the moment.

Yet there was nothing to do but go on.

"How long have there been Predictors?" he asked.

"Several hundred years."

"Then it's the result of an invention?"

"There's a legend—" Yanar began. He stopped, and stiffened. Blockage. "I refuse to answer that," he said.

Gosseyn said: "At what stage does the prophetic ability appear?"

"About twelve. Sometimes a little sooner."

Gosseyn nodded half to himself. There was a theory forming in the back of his mind, and this fitted. The faculty developed slowly like the human cortex and like his own extra brain. He hesitated over his next question, because there was an assumption in it that he didn't want Yanar to notice until it was too late. As before he shifted the wire first, then:

"What happens to children of Predictors for whom there's no room in the birth centers?"

Yanar shrugged. "They grow up, and run the islands."

He sat smug. He seemed unaware that he had revealed by implication that only those children became Predictors who went to the birth centers.

His impassivity started another train of thought in Gosseyn's mind. He had been intent, but now it struck him sharply that Yanar was not reacting like a man being subjected for the first time to such an interview as this. He *knew* what it felt like not to have advance awareness of questions. Knew it so well that it didn't upset him.

Like lightning Gosseyn saw the possibilities. He stepped back in his chagrin. It seemed incredible that it had taken him so long to realize the truth. He stared down at the

Predictor, and said finally in a level but steely voice:

"And now, you will please describe exactly how you have been communicating with the Follower."

If ever a man was caught by surprise, then Yanar was that man. He seemed unprepared in the extreme thalamic fashion. His face turned livid. The neural flow from his nervous system blocked and then burst, and then blocked and burst again.

"What do you mean?" He whispered the words finally.

Since the question was rhetorical, Gosseyn did not repeat his statement. He glowered down at the Predictor. "Quick!" he said. "Before I kill you."

Yanar sagged limply back into his chair, and once more he changed color. He flushed. "I didn't," he stammered. "Why should I endanger myself by calling the Follower and telling him where you were? I wouldn't do a thing like that."

He shook himself. "You can't prove it," he said.

Gosseyn didn't need proof. He had been dangerously remiss in not keeping a watch on Yanar. And so the message had been sent and the damage done. Gosseyn had no doubt of that. The Predictor's reactions were too violent and too realistic. Yanar had never had to control his emotions, and so now he didn't know how. Guilt poured from every reflex in his body.

Gosseyn felt chilled. But he had done what he could to protect himself, and so there was nothing to do but obtain more information. He said curtly:

"You'd better talk fast, my friend, and truthfully. Did you contact the Follower himself?"

Yanar was sullen. He shrugged, and once more that was a signal for a block to break. "Of course," he said.

"You mean, he expected a call from you?" Gosseyn wanted that clear. "You're his agent?"

The man shook his head. "I'm a Predictor," he said.

There was pride in his tone, but it was a bedraggled variety. A lock of his iron-gray hair had sagged over one temple. He looked like anything but a nobleman of Yalerta.

Gosseyn did not comment on the boast. He had his man on the run, and that was what counted.

"What did you tell him?"

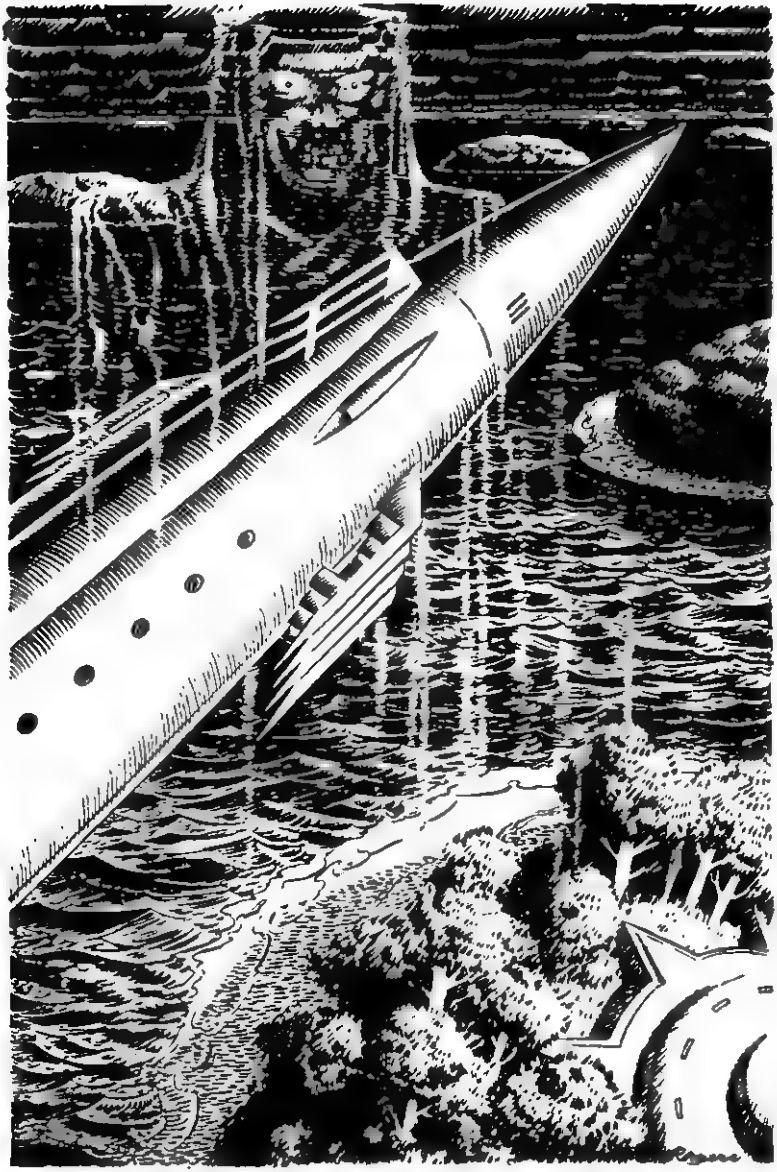
"I said you were aboard."

"And what did he say?"

"He said he knew that."

"Oh!" said Gosseyn. He paused, but only for a moment.

His mind jumped ahead to other aspects of the situation. In quick succession he rapped out a dozen vital questions. The moment he had his facts he "similarized" the both of them into the control room, and stood over the trembling Yanar while he produced maps, and showed the wide circular course the ship had been following round and



round the Follower's island, at a radius of a hundred miles.

Gosseyn reset the course for the island of Crest, only a few hundred miles north by northwest. Then he turned to confront the Predictors.

"And now," he said in a threatening tone, "we come to the problem of what to do with a traitor."

The older man was pale, but some of his fear had departed. He said boldly, "I owe you nothing. You can kill me, but you can't expect loyalty from me, and you won't get it."

It wasn't loyalty that Gosseyn wanted. It was fear. He must make certain that these Predictors learned to think twice before they acted against him. But what to do?

It seemed impractical to make a definite decision. He turned on his heel and headed back into the drawing room. As he entered, Leej appeared from the direction of the bedrooms. He walked toward her, a faint frown on his face. *A few questions, madam,* he thought bleakly. *How was it that Yanar could warn the Follower without his action being predictable? Please explain that.*

The woman stopped, and waited for him, smiling. Her smile changed abruptly. Her gaze plunged past him and slightly to one side. Gosseyn spun around, and stared.

He felt nothing, heard nothing, and there was no sense of a presence even now that he could see. But a shape was taking form a dozen feet to his right. It grew black, and yet he could see the wall beyond it. It thickened, but it was not substance.

He felt himself become tense. The moment of his meeting with the Follower had come.

IX.

Abstracts

Semantics has to do with the meaning of meaning, or the meaning of words. General semantics has to do with the relationship of the human nervous system to the world around it, and therefore it includes semantics. It provides an integrating system for all human thought and experience.

There was silence. The Follower seemed to be regarding him, for the shadowy mass was holding steady now. Gosseyn's brief, intense anxiety began to fade. He stared at his enemy alertly, and, swiftly, his attitude changed.

Actually, what could the Follower do against him?

Cautiously, Gosseyn shifted his gaze for a flickering moment to take in the rest of the scene before him. If there was going to be a battle, he wanted to be in the best possible position for it.

Leej was standing where she had paused. Her body was rigid, her eyes still unnormally wide open. During the fleeting instant that his attention lingered upon her, he noted that the neural sensations that

flowed from her showed an unvarying anxiety. It could be an alarm for her own safety exclusively, but Gosseyn thought not. Her fate was too closely bound up with his. He dismissed all thought of danger from her.

His eyes shifted toward the door of the corridor that led to the control room. For the barest moment, then, he lost sight of the Follower. He twisted back immediately, but he had his fact. The door was too far to the right. He had to turn his head too sharply in order to see it.

Gosseyn began to back toward the wall behind him. He moved slowly. There were several thoughts in his mind, several possibilities of danger. Yanar. The Predictor, he discovered with a swift probe of his extra brain, was still in the control room. Unfriendly vibrations flowed from him.

Gosseyn smiled grimly. He could just imagine how the older man might do him great damage in a critical moment. From memory, he visualized the wall behind him, and it had the air-conditioning slits that he wanted for his purpose. He twisted slightly to one side, until the soft breeze was blowing directly against his back, and there, one heel pressed against the wall, he took up his position.

Having done what he could, he studied his enemy with appraising eyes.

A man? It was hard to believe that a human form could become so shadowy, so insubstantial. The structure of darkness had no form. Gosseyn saw, now that he was looking at it sharply, that it wavered ever so slightly. As he watched, fascinated, it changed and grew fuzzy at the edges, only to fill in again as if a pressure was behind it pushing the foggy stuff forward.

Cautiously, Gosseyn probed into that gaslike thickness. He held himself ready to nullify potent energies.

But there was nothing.

He took his usual prolonged moment to "photograph" an object. And still there was nothing. No image formed.

No normal image, that is. His extra brain registered the presence of air. But the darkness itself came out blank.

He remembered what Leej had said, that the Follower was a being out of phase. He had assumed from other comments that the man had found a way of being out of phase in time. Somehow, not in *this* time. Here, but not now.

Suddenly, now, he realized that he had a more far-reaching assumption than that. He had assumed that Leej knew what she was talking about.

Where would she have gained the idea that the Follower was out of phase? Why, from the propaganda of the Follower! Neither she nor the Predictors had any critical ability, at least not in a scientific sense. These Predictors stole their science from the islands. And so, in their

innocence they had accepted the Follower's own picture.

"Leej!" Gosseyn spoke without looking at her.

"Yes?" shakily.

"Have you ever seen the Follower as a man, without"—he paused, finished sardonically—"his make-up on?"

"No."

"Do you know anybody who has?"

"Oh, yes. Yanar. And oh, many others. He grew up from childhood, you know."

For a tense moment Gosseyn toyed with the idea that Yanar was the Shadow. Yanar standing in the control room manipulating the shadow puppet. He rejected the notion. The man's reactions under questioning, both inward and outward, had been on a provincial level. The Follower was a great man.

The question of how the Follower did what he did was not something about which he could make up his mind on the available evidence. But it was just as well to clear away the assumptions of people who didn't really know the truth.

Gosseyn waited.

A mental finger in his brain quivered on a nerve trigger that would bring the power from the forty thousand kilowatt dynamo in the Followers *Retreat* across the gap of space, and straight into the shadow stuff.

He didn't pull the trigger. This was one time he had no intention of forcing the issue.

He had not long to wait. A deep, resonant voice came out of the shadow emptiness:

"Gilbert Gosseyn, I offer you—partnership."

For a man who had been nerving himself for deadly conflict, the words came with almost the force of a bombshell.

His mind adjusted swiftly. He remained puzzled but his skepticism faded. Actually, Leej had indicated something like this might happen. In describing the Follower's visit to his cell while he still lay unconscious, she had reported the Follower as saying that he preferred to use people rather than kill them.

It was interesting, but not convincing, that he had now decided on equal status.

Gosseyn waited to be convinced.

"Between us," said the shadow-thing in his strong voice, "you and I can dominate the galaxy."

Gosseyn had to smile at that, but it was an unpleasant smile. The word "dominate" was not calculated to win the good will of a person trained as he had been.

Still he made no reply. He wanted to hear every word of the offer without any more comment than was necessary.

"I warn you, of course," said the Shadow, "that if you should prove to be less strong than I suspect, you will eventually have to take a subordinate role. But for the moment

I offer full partnership, without conditions."

Gosseyn grew sardonic. This was thalamic talk. Without conditions indeed! He did not doubt but that he was expected to co-operate with the purposes of the Follower. People tended to project their own hopes and desires, and so a plan for personal aggrandizement became *the* plan.

Next move: bloodthirsty threats.

"If you refuse," said the resonant voice, "then you and I are enemies, and you will be destroyed without mercy."

And that, Gosseyn presumed cynically, was that. The pattern of the neurosis was complete.

His analysis must have been correct. Silence settled over the room, and once more for a little time there was only the movement of the ship as it raced through the night sky on wings of magnetic power.

It was clear that he was now expected to make an answer.

Well, what ought he to say?

From the corner of his eyes, Gosseyn saw that Leej was edging cautiously toward a chair. She made it, and sighed audibly as she sank into it. That brought a bleak amusement to Gosseyn, which passed as the Follower said in his steeliest tone:

"Well?"

There was the beginning of purpose in Gosseyn now, a half determination to test the strength of the other. Test it now. But first, as much information as he could get.

"What's the war situation?" he temporized.

"I predict unqualified victory for Enro in three months," was the reply.

Gosseyn hid his shock. "You actually *see* the moment of victory?"

The pause, then, was so slight that Gosseyn wondered afterwards if it had occurred, or if he had imagined it.

"I do," was the firm reply.

He couldn't accept that, since it failed to take his extra brain into account. The strong possibility that he was being lied to made him sardonic again.

"No blurs?" he said.

"None."

There was an interruption, a movement from Leej. She sat up. Then:

"That," she said in a clear voice, "is a lie. I can foresee everything that anyone else can. And it is difficult to prophesy in detail for more than three weeks. Even that is always within certain limits."

"Woman, hold your tongue!"

Leej's color was high. "Follower," she said, "if you can't win with the power you really have, then you are as good as lost. And don't think for an instant that I feel myself bound to obey your orders. I do not desire, and never have desired, your victory."

"Good girl," said Gosseyn.

But he frowned, and noted a point for future reference. There was in her words a veiled implication of

previous collaboration with the Follower.

"Leej," he said without looking at her, "are there any blurs in the next few weeks?"

"There is no picture at all," was the answer. "It's as if everything is cut off. The future is a blank."

"Perhaps," said the Follower softly but resonantly, "that is because Gosseyn is about to die."

He added quickly: "My friend, you have five seconds to make up your mind."

The five seconds passed in silence.

Gosseyn had expected, if an attack came, it would be one of three types. First, the Follower might try to utilize the magnetic power of Leej's ship against him. He'd quickly discover that that wouldn't work.

Second, and most likely, he'd use a source of power in the *Retreat,* since that was his base of operations. He'd quickly discover that that wouldn't work either. Third, he would use an outside source of power. If it was the latter, Gosseyn's hope was that it operated across space and not by mechanical similarity.

If it came by space, the tubes he had set up would detect it and his extra brain could then "similarize" electric energy onto the carrier beam of the tubes.

It turned out to be a combination. A Distorter and an electric power source in the *Retreat.* Gosseyn felt the abrupt re-direction of the current from the forty thousand kilowatt dynamo. It was what he had been waiting for, was ready for. There were "switches" in his extra brain which, once set to cues, operated faster than any electric switch.

The problem, with his special method of controlling matter and energy, was that in a comparative sense it took a long time to "set" the initial pattern.

The cue was automatic.

All the power of the dynamo flowed, not as the Follower directed, into a blaster, but according to the extra brain pattern. At first Gosseyn let it churn harmlessly into the ground at one of his "memorized" areas on the island. He wanted the Follower to realize that the attack was not proceeding according to plan.

"One, two, three," he counted deliberately, and then without further pause "similarized" it into the air directly in front of the shadow shape.

There was a flash of flame, brighter than the sun.

The shadowy stuff absorbed it, and held. It took every volt and watt, wavering as it did so, but not unnormally. It held.

Presently, the Follower said: "We seem to be at an impasse."

It was a reality that had already struck home to Gosseyn. He was all too keenly aware of his own shortcomings. It was not apparent, but Gilbert Gosseyn was ridiculously vulnerable. A surprise blast from a source of power over which he had

not previously established control, and he would be dead.

The fact that his memory would go on in the body of an eighteen year old, and that there would be an apparent life continuity did not alter the meaning of the defeat. No youth of eighteen would ever save a galaxy. And if such an individual, or even several such individuals interfered too much, they also could be removed from the scene by older and more powerful individuals like the Follower.

The perspiration stood out on his face. Just for a moment, there was a plan in his mind, to attempt something he had never tried before. But he rejected it almost instantly. Atomic energy was simply one more power that he could control with his extra mind. But to know that he could do it, and actually to do it, were entirely different aspects of the problem.

In this confined space, atomic radiation could be as deadly to the user as to the person it was used against.

"I think," the Follower's voice cut across his thoughts, "we'd better come to an agreement. I warn you I have not used all my resources."

Gosseyn could well believe that. The Follower need merely turn to an outside source of power, and instantly he would be the victor in this tense and deadly battle. At best, Gilbert Gosseyn could retreat to the Follower's island. The possibility of an ignominious recapture was as close as that.

And still he dared not use the atomic energy from the pile in the *Retreat*.

He made the famous thalamo-cortical pause, and consciously said to himself, "There is more to this situation than is apparent. No individual can take the output of a forty thousand kilowatt dynamo. Therefore, I am making an identification. There must be an explanation for the shadow shape which was beyond my own understanding of physics."

But whose physics? The Follower had confessed that he knew little of such things. Whose vast knowledge was he using?

The mystery seemed as great as that posed by the existence of such a being as the Follower.

The shadow shape broke the silence. "I admit," he said, "that you've caught me by surprise. Next time I'll operate on a different basis." He broke off. "Gosseyn, will you consider any kind of partnership?"

"Yes, but on my conditions."

"What are they?" After a brief hesitation.

"First, that you turn the Predictors against Enro."

"Impossible." The Follower's voice was curt. "The League must go down, civilization briefly lose its cohesion. I have a very special reason for requiring the makings of a universal state."

Gosseyn remembered wryly where he had heard that before. He stiffened. "At a cost of a hundred bil-

lion dead," he said. "No, thank you."

"I suppose you're a null-A." Grimly.

There was no point in denying that. The Follower knew that Venus existed, knew where it was, and could presumably order its destruction at any time. "I'm a null-A," Gosseyn admitted.

The Follower said: "Suppose I told you I was prepared to have a null-A universal state."

"I'd hesitate to accept that as a fact."

"And yet, I might consider it. I haven't had time to examine this non-aristotelian philosophy in detail, but as I see it, it's a method of scientific thinking. Is that correct?"

"It's a way of thinking," said Gosseyn cautiously.

The Follower's voice had a musing tone in it when he spoke again. "I've never yet," he said, "had reason to fear science in any of its branches. I don't think I need to begin now. Let me put it like this. Let us both give this matter further consideration. But next time we meet you must have made up your mind. Meanwhile, I shall try to prevent you from making any more use of power on this planet."

Gosseyn said nothing, and this time the silence continued. Slowly, the shadow shape began to withdraw.

Even in that bright light it was difficult to decide when the last wisp of it faded out of sight.

There was a pause. And then the dynamo in the Follower's *Retreat* began to give off less power. In thirty seconds the power was off.

Another pause. And then the pile went dead. Almost at the same instant, the magnetic power in the *Retreat* faded off into nothingness.

The Follower had made a shrewd guess as to what had happened. Even if he didn't suspect the full truth, he had now taken action that had all the effect of a complete and accurate analysis.

Only the magnetic power of a small ship remained in the control of Gilbert Gosseyn.

X.

Abstracts

For the sake of sanity, DATE: Do not say, "Scientists believe . . . ." Say, "Scientists believed in 1948 *. . ." "John Smith* (1948) *is an isolationist . . ." All things, including John Smith's political opinions, are subject to change and can therefore only be referred to in terms of the moment.*

Slowly, Gosseyn let himself become aware again of his surroundings. He turned his head and glanced toward the dining room, where the servants had been so busy a short time before. They were not in sight. He could see the edge of the table, and all the dishes seemed to be on it, though no food was visible.

His gaze leaped to Leej, paused

long enough for him to notice that she was climbing to her feet, and then flashed on to the door that led to the control room. From where he stood, the full length of the corridor and even a part of the dome window was visible, but there was no sign of Yanar.

The ship remained steady on its course.

Leej broke the silence between them. "You've done it," she whispered.

Gosseyn walked forward from the wall. He shook off her words, but he did not tell her that the Follower had just nullified whatever victory he had gained.

Leej came toward him now, her eyes glowing. "Don't you realize," she said, "you've beaten the Follower?"

She touched his arm with a quick, tremulous caress of her fingers.

Gosseyn said: "Come along."

He headed toward the control room. When he entered, Yanar was bending expectantly over the magnetic radio receiver. For Gosseyn it was apparent at a glance what the man was doing—still waiting for instructions. Without a word he walked forward, reached past Yanar's shoulder and shut off the instrument.

The other started violently, then straightened, and turned with a sneer on his lips. Gosseyn said:

"Pack your bags if you have any. You're getting off at the first stop."

The Predictor shrugged. Without a word he stalked from the room.

Gosseyn stared after him thoughtfully. The man's presence annoyed him. He was an irritation, a minor nuisance whose only importance in the galactic scheme of things was that he was a Predictor. That, in spite of his obstinate and petty character, made him interesting.

Unfortunately, he was but one man out of more than two million, neither typical nor atypical of his kind. It was possible to make certain cautious hypotheses about the Predictors from his observation of Yanar and Leej. But such conclusions must be subject to change without notice.

He dismissed Yanar from his mind, and turned to Leej. "How long will it take us to get to Crest, where the warship is?"

The young woman walked over to a plate on the wall, which Gosseyn hadn't noticed before. She pressed a button. Instantly, a map sprang into sharp relief. It showed water and islands, and a tiny point of light.

She indicated the brightness. "That's us," she said. She pointed at a land mass higher up. "There's Crest." Carefully, she counted finely ruled lines that crisscrossed the map. "About three hours and twenty minutes," she said. "We'll have plenty of time to eat dinner."

"Eat!" Gosseyn echoed. And then he smiled, and shook his head in a half apology to himself. He was tremendously hungry, but he had almost forgotten that such normal instincts existed.

It was going to be pleasant to relax.

Dinner.

Gosseyn watched as the young girl served him a cocktail glass that contained segments of what seemed to be fish. He waited alertly while Yanar was served by one of the older women, and then transposed the two glasses by similarization.

He tested his own cocktail. It was fish, sharply flavored. But, after the initial shock to his taste buds, delicious. He ate it all, then put down his fork, sat back and looked at Leej.

"What goes on in your mind when you foresee?"

The young woman was serious. "It's automatic."

"You mean, there's no pattern you follow?"

"Well—"

"Do you pause? Do you think of an object? Do you have to see it?"

Leej smiled, and even Yanar seemed more relaxed, even slightly, if tolerantly, amused. The woman said: "We just have, that's all. It's not something that has to be thought about."

So those were the kind of answers they gave themselves. They were different. They were special. Simple answers for simple people. Actually, the complication was of an unparalleled order. The Predictor processes occurred on a nonverbal level. The whole system of Ā was an organized attempt to co-ordinate nonverbal realities with verbal projections. Even on Ā Venus the gap between interpretation and event had never been more than partially bridged.

He waited while the empty glasses were removed, and they were each served a plate containing a brownish red meat, three vegetables and a thin sauce of greenish color. He exchanged his for Yanar's, tasted each of the vegetables in turn, and then cut off a piece of the meat. Finally, he sat back.

"Try to explain," he said.

Leej closed her eyes. "I've always thought of it as floating in the time stream. It's a spreading out. Memories are coming into my mind, but they aren't really memories. Very clear, very sharp. Visual pictures. What is it you want to know? Ask about something not connected with yourself. You blur everything."

Gosseyn had laid down his fork. He would have liked a prediction about Venus, but that would require projection of his future. He said: "The girl who's serving me."

"Vorn?" Leej shook her head and smiled at the girl, who was standing rigid and colorless. "It's too hard on their nervous systems. I'll tell you her future privately later on, if you wish." The girl sighed.

"The galactic warship," said Gosseyn, "on Crest?"

"You must be connected with that, because it's blurred."

"Blurred now?" He was sur-

prised. "Before we actually get there?"

"Yes." She shook her head. "This is not answering your questions, is it?"

"Could we get through to another star system if somebody was going there?"

"It depends on the distance. There is a limitation."

"How far?"

"I don't know. I haven't had enough experience."

"Then how do you know about it?"

"The galactic recruiting ship gives out bulletins."

"Bulletins?"

She smiled. "They're not depending entirely on the Follower's orders. They're trying to make it seem exciting."

Gosseyn could imagine how that would work. The project was being made to sound fascinating for the benefit of minds that had many childlike qualities. And the publicists were smart enough to indicate that there were obstacles.

"These mental pictures," he said. "Can you follow the future-lines of some person you know who volunteered for warship service?"

She sighed, and shook her head. "It's too far. The bulletin once mentioned eighteen thousand light-years."

Gosseyn remembered that Crang had indicated in his conversation with Patricia Hardie, or rather Reesha, sister of Enro, that the Distorter transport bases of galactic civilization could not be more than about a thousand light-years apart.

Theoretically, similarity transport was instantaneous, and theoretically spatial distance made no difference. In practice there seemed to be a margin of error. The instruments were not perfect. Twenty decimal similarity, the critical point where interaction occurred, was not total similarity.

Apparently, the Predictor gift was also imperfect even when not impeded by the presence of Gilbert Gosseyn. Still, whatever the distance over which they could predict, it would be adequate for the purposes of a battle in space.

Gosseyn hesitated, then: "About how many ships' movements could they take into account at the same time?"

Leej looked surprised. "It doesn't really matter. All of them, of course, that had any connection with the event. It's very limited in that way."

"Limited!" said Gosseyn.

He stood up, and without a word headed for the control room.

He had been undecided about the Predictors. Prepared to let the galactic ship go on recruiting them until he made up his mind just when he would try to seize it. Now, it seemed to him that might be a long way off. One man didn't capture a battleship without planning.

A preliminary move was necessary.

At the end of the living room,

Gosseyn stopped and turned: "Leej," he called, "I'll be needing you."

She was already on her feet, and she joined him a minute later in the dome. "That was a short dinner," she said anxiously.

"We'll finish it later," said Gosseyn. He was intent. "Is there any band on this radio that can be used for sending a general message?"

"Why, yes. We have what we call an emergency band that—" She stopped. "It's used to co-ordinate our plans when we are threatened."

Gosseyn said: "Set it."

She gave him a startled look, but there must have been something in his expression that decided her to say no more. A moment later, Gosseyn was on the air. As before—it was now quite automatic—he shifted the wire immediately before each sentence he spoke. He said in a ringing voice:

"Calling all Predictors! From this moment every Predictor who is discovered or captured aboard a warship of the Greatest Empire will be executed. Friends are advised to communicate this warning to people who are already aboard such ships. You may all judge the effectiveness of this threat by the fact that you did not foresee the call that I am now making. I repeat: Every Predictor found aboard an Enro warship will be executed. There are no exceptions."

He returned to the dining room, finished his dinner, and then went back to the control room. From its vantage point two and a half hours later he saw the lights of a city in the distance. At Yanar's request, the ship was brought down at what Leej called a Predictor air station. As soon as they were up in the air again, Gosseyn set the accelerator to "Full," and then slipped to the window, and looked down at the city below. So many people. He saw the lights entwined with innumerable curling fingers of water. In some cases the ocean twisted right through the center of the city.

As he watched, all the lights went out. Gosseyn stared, but there was blackness. Beside him, Leej uttered an exclamation.

"I wonder why they did that."

Gosseyn could have answered the question, but he didn't. The Follower was taking no chances. He evidently had a theory about the nature of Gilbert Gosseyn's control over energy, and he intended to see that no energy was available.

Leej said: "Where are we going now?"

When he told her, some of the color went out of her face. "It's a warship," she said, "there are hundreds of soldiers aboard, and weapons that could kill you from many different directions at once."

That was true enough. The danger of trying to use his special powers to seize a ship was that it would be virtually impossible to nullify or control many scores of hand weapons. It was under such circum-

stances that fatal accidents could occur all too easily.

But what had happened put a pressure on him to act more swiftly than he had planned. The reality was that he had already used his strongest weapons against the Follower. Therefore, the sooner he got away from Yalerta the better. Somewhere out in the galaxy there might be scientific understanding of what made the Follower invulnerable, and actually, until he found a rational approach, he'd better stay away from the man.

Besides, the galactic warship was the only method he knew of to get off this isolated planet.

The greatest risks were in order.

In half an hour there was light ahead. At first, the galactic ship was little more than a bright blur in the midnight darkness, but presently, so brilliant were the lights around it, it was clearly visible. Gosseyn set Leej's airship into a wide orbit around the bigger ship, and studied the approaches through a magnetic powered telescope.

The stranger was about six hundred feet long. A small ship indeed by galactic standards. But then it had only one purpose on Yalerta. Aboard was a Distorter transport instrument of the type that produced mechanical similarity. As an invention it had probably no equal in the history of science. With it, man could move across the vast distances of space as if there was no space. A Predictor on Yalerta need merely step into the Distorter aboard the warship, and he would be transported a hundred or a thousand light-years away almost instantly. The margin of error, as he had discovered with the organic distorter in his head, was small but noticeable.

The ship lay on a level plain. During the forty minutes that Gosseyn watched it, two skytrailers came out of the darkness. They came at different times, and floated down to a landing near a blaze point that must be an air lock. Gosseyn presumed that these were volunteers, and what interested him was that, on each occasion, the trailer departed before the volunteer was allowed aboard the galactic ship.

It was just such details that he had been waiting to find out.

They approached boldly. At five miles he was able to sense the energy aboard—and received his great disappointment. Electricity only, and in unimportant quantities. The drive pile had been damped.

Mentally, Gosseyn drew back from the venture. In his anxiety, he began to whistle under his breath. He was aware of Leej watching him.

"Why, you're nervous," she said wonderingly.

Nervous, he thought grimly, uncertain, undecided. Very true. As things stood now, he could wait in the hope of improving his position with regard to the ship. Or he

could make a test try to capture it immediately

"This power of yours," said Leej, "the way you do things—how does it work?"

She was wondering about that at last, was she? Gosseyn smiled, and shook his head.

"It's a little involved," he said, "and without wishing to be offensive I think is beyond your scientific training. It goes something like this. The extensional area we call space-time is probably an illusion of the senses. That is, any reality they have bears little relation to what you see, feel or touch. Just as you seem to be better orientated as a Predictor to the real space-time continuum, with emphasis on the time element —that is, better orientated than the average individual so I am better orientated but in my case the emphasis seems to be on space."

She seemed not to have heard. "You're not actually all-powerful, are you? Just what are your limitations?"

"Do you mind," said Gosseyn, "if I tell you later? I've just made up my mind about something."

A pale Leej guided the airship through the night, and grew paler as she listened to his instructions. "I don't think you have any right," she said shakily, "to ask me to do such a thing."

Gosseyn said: "I'd like to ask you one question."

"Yes?"

"When you were in the cell with Jurig, what would have happened if he had killed me? Would the Follower have rescued you?"

"No, I was merely a device to incite you to your greatest effort. If I failed—it was my failure, also."

"Well?" said Gosseyn softly.

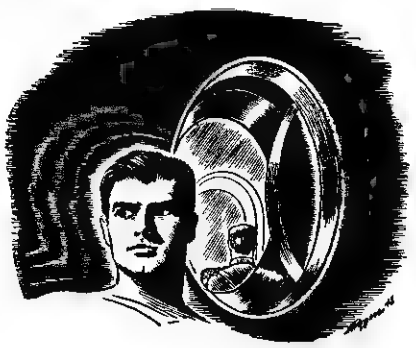
The woman was silent, her lips pursed. The neural flow from her had changed from an anxious unevenness to a tense but steady pattern. She looked up at last.

"All right," she said, "I'll do it."

Gosseyn patted her arm in silent approval. He did not fully trust Leej. There was a possibility that this also was a trap. But the shadow thing had already discovered that imprisoning Gilbert Gosseyn was easier said than done.

Gosseyn's eyes narrowed with determination. He was a man who had to keep moving. He felt immensely confident of his ability to do so, as long as he did not become too cautious in the face of necessity.

His reverie broke, as the beam of a searchlight penetrated the dome. There was a click as the magnetic



receiver went on, and a man's voice said:

"Please land in the lighted area a hundred yards from our entrance."

Leej took the ship down without a word. When they had come to rest, the voice spoke again from the receiver. "How many are coming?"

Gosseyn held up a finger to Leej, and motioned for her to answer. "One," she said.

"Sex?"

"Female."

"Very well. One female person will emerge from your ship and approach the admission office at the foot of the gangplank. The trailer will leave immediately and go to a distance of five miles. As soon as it has retreated the required distance, the volunteer will be allowed aboard our ship."

So it was five miles that the trailers were supposed to go. It seemed to Gosseyn that the two volunteers he had observed earlier had been admitted before anything like that distance had been covered by the ships that had brought them.

It was the same way with Leej. Gosseyn, who had "similarized" himself to the rear control room, watched her pause at the small structure beside the lower end of the gangplank. After little more than a second she started up the gangplank.

He glanced at the speedometer. The trailer had gone one and one-eighth Yalertan miles.

It could mean one of two things. First, this was a trap, and he was being lured. Or second, the space veterans had become bored, and were no longer adhering to the rules.

Of course, it could be a combination. A trap by the Follower, of which the ship's crew knew nothing. Or perhaps they had even been warned, and didn't take the threat seriously.

One by one Gosseyn ticked off the possibilities in his mind, and each time came back to the same reality. It made no difference. He had to make the attempt.

As he watched, Leej disappeared through the lock. He waited patiently. He had set himself four minutes *after* she got inside. In a way it was a long time to leave her alone.

He waited, and he felt strangely without regrets. For a moment, when she had protested her inclusion, he had wondered if he was not pushing her too hard. That wonder was past. It had seemed to him then, and still did, that the ship's crew would have been warned against a man, not a woman. Therefore, hers must be the risk of making the initial entry.

If she got inside, then so would he. There were other methods, but that was the fastest. He had plans for Leej, but first of all she must acquire the feeling that her fate was bound up with his.

He glanced at the clock, and ex-

perienced a thrill. The four minutes were up.

He hesitated a moment longer, and then "similarized" himself to the open porthole beside the air lock. It was touch and go for a second as he clawed for a hold. And then his arm was straddling the metal seat of the porthole.

It had seemed like a good place to enter, and so he had "photographed" it through the telescope while the trailer was still on the ground.

He drew himself into the tunnel-like porthole.

XI.

Abstracts

For the sake of sanity, INDEX: Do not say, "Two little girls . . ." unless you mean, "Mary and Jane, two little girls, different from each other, and from all the other people in the world . . ."

From where he lay straddling the porthole, Gosseyn could hear the murmur of conversation. It was subdued, so that no word came through. But the talking was between a woman and a man.

Cautiously, Gosseyn peered around the inner rim of the porthole. He looked down into a broad corridor. About thirty feet to his left was the open air lock through which Leej had come. To his right he could see Leej herself standing in a doorway and beyond her, with only his shoulder and arm visible, was a man in the uniform of an officer of the Greatest Empire.

Except for the three of them, the corridor was deserted.

Gosseyn lowered himself to the floor, and keeping to the far wall, approached the couple.

As Gosseyn came up, Leej was saying: ". . . I think I'm entitled to the details. What arrangements have been made for women?"

Her tone was calm, with just the right note of demand in it. The officer's voice, when he answered, held a resigned patience.

"Madam, I assure you, a six-room apartment, servants, every convenience, and authority second only to that of the captain and his first officers. You are—"

He stopped, as Gosseyn stepped into the doorway beside Leej. His surprise lasted only a few seconds.

"I beg your pardon," he said, "I didn't see you come aboard. The admission officer outside must have forgotten to ."

He stopped again. He seemed to realize the improbability of the admission officer having forgotten anything of the kind. His eyes widened. His jaw sagged slightly. His plump hand moved jerkily toward the blaster at his side.

Gosseyn hit him once on the jaw. And caught him as he fell.

He carried the unconscious body to a couch. He searched the man quickly, but found only the blaster in the holster. He straightened, and looked around. He had already noticed that in addition to the or-

dinary furnishings, the room contained a number of Distorter type elevators. Now, he counted them. One dozen, and not elevators, really. He'd called them that ever since he had mistaken them for elevators when he was in Enro's secret Venusian base.

One dozen. The sight of them in a row against the wall farthest from the door clarified his mental picture. This was the room from which Yalerta's Predictors were sent to their assigned posts. The process was even simpler than he had thought. There seemed to be no preliminaries. The admission officer allowed a volunteer onto the gangplank. And then this plump man led them into this room, and shipped them to their destination.

The rest of the ship was apparently unaffected. The officers and men lived their routine existence apart from the purposes for which their ship had come to Yalerta. And since it was after midnight they might possibly be asleep.

Gosseyn felt stimulated at the mere idea.

He stepped back to the door. As before, the corridor was deserted. Behind him, Leej said:

"He's awakening."

Gosseyn returned to the couch, and stood waiting.

The man stirred, and sat up, nursing his jaw. He glanced swiftly from Leej to Gosseyn and back again. Finally, he said in a querulous tone:

"Are you two crazy?"

Gosseyn said: "How many men are there aboard this ship?"

The other stared at him, then he started to laugh. "Why you fool," he said. For a moment he seemed to be overcome with renewed amusement. "How many men," he mimicked. His voice rose. "There are five hundred. Just think that over, and get out of this ship as fast as you can."

The crew complement was about what Gosseyn had expected. Spaceships were never crowded in the same fashion as ground vehicles. It was a matter of air and food supply. Still, five hundred men.

"Do the men live in dormitories?" he asked.

"There are eight dormitories," replied the officer. "Sixty men in each one." He rubbed his hands together. "Sixty," he repeated, and his voice relished the figure. "Would you like me to take you down and introduce you?"

Gosseyn allowed the humor to pass him by. "Yes," he said, "yes, I would."

Leej's fingers plucked at his arm nervously. "There's a continuous blur," she said.

Gosseyn nodded. "I've got to do it," he said. "Otherwise *he* would know what I'm doing."

She nodded doubtfully. "So many men. Doesn't that make it complicated?"

Her words were like a spur to the officer. He climbed to his feet. "Let's go," he said jovially.

Gosseyn said: "What's your name?"

"Oreldon."

Silently, Gosseyn motioned him toward the corridor. When they came to the open outer lock, Gosseyn stopped.

"Can you close these doors?" he asked.

The man's plumpish face glowed with conscious good humor. "You're right," he said. "We wouldn't want any visitors while I was off duty." He stepped briskly forward, and he was about to press the button when Gosseyn stopped him.

"A moment, please," he said. "I'd like to check those connections. Wouldn't want you setting off an alarm, you know."

He unfastened the plate and swung it open. By count, there were four wires too many. "Where do they go?" he asked Oreldon.

"To the control room. Two for opening, two for shutting."

Gosseyn nodded, and closed the panel. It was a chance he had to take. There would always be a connection with the control board.

Firmly, he pressed the button. Metal stirred, thick slabs of it glided across the opening and clanked shut with a steely sound.

"Mind if I talk to my partner outside?" Oreldon asked.

Gosseyn had been wondering about the man outside. "What do you want to say to him?" he asked.

"Oh, just that I've closed the door, and that he can relax for a while."

"Naturally," said Gosseyn, "you will be careful how you word it."

"Of course."

Gosseyn checked the wiring, then waited while Oreldon switched on a wall phone. He recognized that the other was in a state of thalamic stimulation. Accordingly, he would be swept along by the intoxicating flood of his own humor until the shock of imminent disaster sobered him. That would be the moment to watch for.

Apparently, the doors were not always open, for the admission officer did not seem surprised that they were closed. "You're sure," Orry," he said, "that you're not going off with that female who just came in?"

"Regretfully, no," said Oreldon, and broke the connection. "Can't have these conversations going on too long," he said heartily to Gosseyn. "People might get suspicious."

They came to a stairway. Oreldon was about to start down it when Gosseyn restrained him. "Where does this lead?" he asked.

"Why, down to the men's quarters."

"And where's the control room?"

"Oh, you wouldn't want the control room. You have to climb for that. It's up front."

Gosseyn said gravely that he was happy to hear that. "And how many openings are there into the lower deck?" he asked.

"Four."

"I hope," said Gosseyn pleasantly, "that you're telling me the truth. If I should discover that there are five, for instance, this blaster might go off suddenly."

"There's only four, I swear it," said Oreldon. His voice was hoarse suddenly.

"You see," said Gosseyn, "I notice there's a heavy door that can slide over this stairway."

"Wouldn't you say that was normal?" Oreldon was back in the groove again. "After all, a spaceship has to be built so that whole sections can be sealed off in case of accident."

"Let's slide it shut, shall we?" said Gosseyn.

"Huh!" His tone showed that he hadn't even thought of such a thing. His pasty face showed that this was the moment of shocked realization. His eyes rolled as he glared helplessly along the corridor. "You don't think for one second," he snarled, "that you're going to get away with this."

"The door," said Gosseyn in an inexorable tone.

The officer hesitated, his body rigid. Then slowly he walked to the wall. He opened a sliding panel, waited tensely until Gosseyn had checked the wiring and then jerked the lever. The door panels were only two inches thick. They closed with a faint thud.

"I sincerely hope," said Gosseyn, "that they are now locked, and that they can't be opened from beneath, because if I should discover differently I would always have time to fire this blaster at least once."

"They lock," said Oreldon sullenly.

"Fine," said Gosseyn. "But now let's hurry. I'm eager to have those other stairways cut off also."

Oreldon kept glancing anxiously along side corridors as they walked, but if he hoped that they would see a member of the crew, he was disappointed. There was silence except for the faint sound of their own movements. No one stirred.

"I think everyone must have gone to bed," said Gosseyn.

The man did not respond. They completed the task of shutting off the lower floor before another word was spoken, then Gosseyn said: "That should leave twenty officers including you and your friend outside. Is that right?"

Oreldon nodded, but he said nothing. His eyes looked glazed.

"And if I remember my ancient history of Earth correctly," said Gosseyn, "there used to be an old custom –due to the intransigent character of some people of confining officers to their quarters under certain circumstances. That always meant a system of outside locks. It would be interesting if Enro's warships also had problems, and solutions, like that."

He had to take only one glance at his prisoner's face to realize that Enro's ships had.

Ten minutes after that, without a shot having been fired, he was in

complete control of the galactic warship.

It had been too easy. That was the feeling that grew on Gosseyn as he peered into the deserted control room. Herding Oreldon ahead of him, and with Leej bringing up the rear, he entered the room. Critically, he looked around.

There was slackness here, not a single man on duty, except the two officers who looked after the Predictors.

Too easy. Considering the precautions that the Follower had already taken against him, it seemed unbelievable that the ship was his in reality.

And yet, it seemed to be.

Once more he gave his attention to the room. The instrument board curved massively beneath the transparent dome. It was divided into three sections, electric, Distorter and atomic. First, the electric.

He manipulated the switches that started an atomic powered dynamo somewhere in the depths of the ship. He felt better. As soon as he had "memorized" enough sockets, he would be in a position to release intolerable energy into each room and along every corridor. It was tremendously convincing. If this was a trap, then the crew members were not in on it.

But still he was dissatisfied. He studied the board. There were levers and dials on each section, the purposes of which he could only partially guess. He did not worry about the electric or the atomic. The latter could not be used within the confines of the ship. And the former he would shortly control without qualification.

That left the Distorter. Gosseyn frowned. There was no doubt of it. Here was the danger. Despite his possession of an organic Distorter in what he called his extra brain, his knowledge of the mechanical Distorter system of the galactic civilization was vague. In that vagueness his weakness must lie, and the trap, if there was a trap.

In his preoccupation, he had moved back from the board. He was standing there, teetering between several possibilities, when Leej said:

"We'll have to sleep."

"Not while we're on Yalerta," said Gosseyn.

His main plan was fairly clear. There was a margin of error between perfect similarity and the twenty decimal similarity of the mechanical Distorter.

Measured by spatial distance, it came to about a thousand light-years every ten hours. But that also, Gosseyn had already surmised, was an illusion. He explained to Leej:

"It's not really a question of speed. Relativity, one of the earliest and most encompassing of null-A formulations, shows that factors of space and time cannot be considered separately. But I'm coming around to another variation of the same idea. Events occur at different moments, and separateness in space

is merely part of the image that forms in our nervous systems when we try to interpret the time gap."

He saw that once more he had left the woman far behind. He went on, half to himself:

"It's possible that two given events are so closely related that in fact they are not different events at all, no matter how far apart they seem to be, or how carefully defined. In terms of probability—"

Gosseyn stood frowning over the problem, feeling himself on the edge of a much greater solution than that required by the immediate situation. Leej's voice distracted his attention.

"But what are you going to do?"

Gosseyn stepped once more to the board. "Right now," he said, "we're taking off on normal drive."

The control instruments were similar to those on the ships that plied the space between Earth and Venus. The first upward thrust tensed every plate. The movement grew continuous. In ten minutes they were clear of the atmosphere, and gathering speed. After twenty-five minutes more, they emerged from the umbral cone of the planet, and sunlight splashed brilliantly into the control room.

In the rearview plate, the image of the spinning world of Yalerta showed as a saucer of light holding a vast, dark, misty ball. Gosseyn turned abruptly from the scene, and faced Oreldon. The officer turned pale when Gosseyn told him his plan.

"Don't let him guess I'm responsible," he begged.

Gosseyn promised without hesitation. But it seemed to him that if a military board of the Greatest Empire should ever investigate the seizure of the Y-381907 the truth would be quickly discovered.

It was Oreldon who knocked on the captain's door, and presently emerged accompanied by a stocky, angry man. Gosseyn cut his violent language short.

"Captain Free, if it should ever be discovered that this ship was captured without the firing of a shot, you will probably pay with your life. You'd better listen to me."

He explained that he wanted the use of the ship temporarily only, and Captain Free calmed enough to start discussing details. It appeared that Gosseyn's picture of how interstellar ships could operate was correct. Ships were set to go to a distant point, but the pattern could be broken before they got there.

"It's the only way we can stop at planets like Yalerta," the captain explained. "We similarize to a base more than a thousand light-years farther on, then make the break."

Gosseyn nodded. "I want to go to Gorgzid, and I want the pattern to break about a day's normal flight away."

He was not surprised that the destination startled the other. "Gorgzid!" the captain exclaimed. His eyes narrowed, and then he smiled grimly. "They should be

able to take care of you," he said. "Well, do you want to go now? It will take seven jumps."

Gosseyn did not answer immediately. He was intent on the neural flow from the man. It was not quite normal, which actually was natural enough. There were uneven spurts indicating emotional disturbances, but there was no purposeful pattern. It was convincing. The captain had no plans, no private schemes, no treachery in mind.

Once more he considered his position. He was attuned to the electric dynamo, and the atomic pile of the ship. He was in a position to kill every man aboard in a flash. His position was virtually impregnable.

His hesitation ended. Gosseyn drew a deep breath, and then:

"Now!" he said.

XII.

Abstracts

For the sake of sanity, use ET CETERA: When you say, "Mary is a good girl!" be aware that Mary is much more than "good." Mary is "good," nice, kind, et cetera, meaning she also has other characteristics. It is worth remembering, also, that modern psychiatry—1948—does not consider the placidly "good" individual a healthy personality.

He had held himself tense, half expecting that an attempt would be made to use the momentary blackout against him. Now, he turned, and said:

"That was certainly fast enough. We—"

His voice faltered—because he was no longer in the control room of the destroyer.

Five hundred feet away was a control board on a vaster plane than the one which he had left only an instant before. The transparent dome that curved up from it was of such noble proportions that for a moment his brain refused to grasp the size.

With a sickening comprehension, he stared down at his hands and body. His hands were thin, bony; his body slim, and dressed in the uniform of a staff officer of the Greatest Empire.

Ashargin!

The recognition was so sharp that Gosseyn felt the body, that he now again occupied, tremble and start to cringe. With an effort he fought off the weakness, but there was despair in him as he thought of his own body far away in the control room of the Y-381907.

It must be lying unconscious on the floor. At this very minute, Oreldon and Captain Free would be overpowering Leej preparatory to capturing the two interlopers. Or rather—Gosseyn made the distinction bleakly—approximately eighteen thousand light-years away, several days before so far as the destroyer was concerned, Leej and

Gilbert Gosseyn's body had been seized.

He must never forget that a time difference resulted from similarity transport.

He grew abruptly aware that his thoughts were too violent for the fragile Ashargin in whose body he was once more trapped. With blurred eyes he looked around him, and slowly he began to adjust. Slowly, because this was not his own highly trained nervous system which he was trying to control.

Nevertheless, presently, his brain cleared, and he stopped trembling. After a minute, though the waves of weakness made a rhythm inside him, he was able to realize what Ashargin had been doing at the moment that he was possessed.

He had been walking along with a group of fleet admirals. He saw them now ahead of him. Two had stopped, and were looking back at him where he stood. One of these said:

"Your excellency, you look ill."

Before Gosseyn-Ashargin could reply, the other man, a tall, gaunt, old admiral, whose uniform sparkled with the jeweled medals and insignia that he wore, said sardonically: "The prince has not been well since he arrived. We must commend him for his devotion to duty at such a time."

As the second man finished speaking, Gosseyn recognized him as Grand Admiral Paleol. The identification brought him even further back to normalcy. For it was something only Ashargin would know.

Clearly, the two minds, his and Ashargin's, were starting to integrate on the unconscious level.

The realization stiffened him. For here he was. Once more he had been picked up by an unseen player, and the essence that was his mind

"similarized" into a brain not his own. The quicker he adjusted the better off he would be.

This time he had to try to dominate his situation. Not a trace of weakness must show. Ashargin would have to be driven to the limit of his physical capacity.

As he hurried forward, to join the other officers, all of whom had stopped now, the memory of Ashargin's last week was beginning to well up. *Week?* The realization that seven days had passed for Ashargin, while he had had less than a full day and night of conscious existence, briefly startled Gosseyn. But the pause it gave him was momentary only.

The picture of the previous week was surprisingly good. Ashargin had not fainted once. He had successfully bridged the initial introductions. He had even tried to put over the idea that he would be an observer until further notice. For a man who had collapsed twice in the presence of Enro, it was an achievement of the first order.

It was one more evidence that even so unintegrated a personality as Ashargin responded quickly, and that only a few hours of control by an Ā trained mind could cause definite improvement.

"Ah," said a staff officer just ahead of Gosseyn-Ashargin, "here we are."

Gosseyn looked up. They had come to the entrance of a small council room. It was evident—and Ashargin's memory backed him up—that a meeting of high officers was about to take place.

Here he would be able to make his new, determined personality of Ashargin felt.

There were officers already in the room. Others were bearing down from various points. As he watched, still others emerged from Distorter cages a hundred feet farther along the wall. Introductions came thick and fast.

Several of the officers looked at him sharply when his name was given. But Gosseyn was uniformly polite to the newcomers. His moment would come later.

Actually, his attention had been distracted.

He had suddenly realized that the great room behind him was the control room of a superbattleship. And more. It was the control room of a ship that was at this very moment engaged in the fantastic battle of the Sixth Decant.

The excitement of the thought was like a flame in his mind. During a lull in the introductions, he felt compelled to turn and look, this time with comprehending eyes. The dome towered a good five hundred feet above his head. It curved up and over him, limpidly transparent, and beyond were the jewel-bright stars of the central mass of the galaxy.

The Milky Way, close-up. Millions of the hottest and most dazzling suns of the galaxy. Here, amid beauty that could never be sur-

passed, Enro had launched his great fleets. He must believe that it was the area of final decision.

Faster, now, came Ashargin's memories of the week he had watched the great battle. Pictures took form of thousands of ships simultaneously "similarized" to the base of an enemy planetary stronghold. Each time, the similarization was cut off just before the ships reached their objective.

Out of the shadowless darkness, then, they darted toward the doomed planet. More ships attacking than all the surrounding sun systems could muster. Distances that would have taken many months, even years, by ordinary flight were bridged almost instantly. And always the attacking fleet gave the victim the same alternative. Surrender, or be destroyed.

If the leaders of any planet, or group of planets, refused to credit the danger, the ruthless rain of bombs that poured from the sky literally consumed their civilization. So violent and so concentrated were the explosions that chain reactions were set up in the planet's crust.

The majority of systems were more reasonable. The segment of fleet which had paused to capture or destroy merely left an occupying force, and then flashed on to the next League base.

There was no real defense. It was impossible to concentrate sizable fleets to oppose the attackers, since it was impossible to know which planetary system was next in line. With uncanny ability the invading forces fought those fleets that were brought against them. The attacking forces seemed always to know the nature of the defense, and wherever the defense was fiercest appeared a dozen Enro ships for every one that was available to the league power.

To Ashargin that was almost magical, but not to Gosseyn. The Predictors of Yalerta were fighting with the fleets of the Greatest Empire, and the defenders literally had no chance.

The flood of memory ended as the Grand Admiral's voice said ironically from behind him: "Prince, the meeting is about to begin."

It was a relief to be able to sit down at the long council table.

He saw that his chair was next to and at the right of the admiral. Swiftly, his eyes took in the rest of the room.

It was larger than he had first thought. He realized what had given him the impression of smallness. Three walls were veritable maps of space. Each was sprinkled with uncountable lights, and on each wall about ten feet up from the floor there were series of squares on which numbers flickered and whirled. One square had red numbers on it, and the figure shown was 91308. It changed as Gosseyn watched and jumped to 91749. That was the largest change he observed as he glanced around.

He waited for some explanation

of the numbers to well up from Ashargin's memory. Nothing came except the information that Ashargin had not before been in this room.

There were squares with numbers in blue, and squares with yellow, green, orange and gray numbers, pink numbers, purple and violet numbers. And then there were squares in which alternate figures were different colors. It was obviously a method of distinguishing facts at a glance, but the facts themselves were unstable.

They changed from moment to moment. The figures went through violent gyrations. They seemed to dance as they shifted and altered. And there was no question but that they told a story. It seemed to Gosseyn that in square after square of cryptic numbers the ever changing pattern of the battle of the Sixth Decant was revealed.

It cost him a tremendous effort to withdraw his fascinated gaze from the squares, and to realize that Admiral Paleol had been speaking for several moments.

". . . Our problems," the gaunt and grim old man was saying, "will scarcely be more difficult in the future than they have already been. But I called you here today to warn you that incidents have already occurred which will probably become more numerous as time goes on. For instance, on seventeen different occasions now, we have been unable to 'similarize' our ships to bases, the Distorter patterns of which were secured for our great leader by the most highly organized spy system ever conceived.

"It is clear that some of the planetary governors have become suspicious and in their panic have altered the patterns. In every case so far brought to my attention, the planets involved were approached by our ships 'similarizing' to a base beyond them, and then 'breaking.' In every case, the offending planet was given no opportunity to surrender, but was mercilessly destroyed.

"These eventualities, you will be happy to know, were foreseen by our great leader, Enro the Red. History has no previous record of one man gifted with such foresight, sagacity and with so great a will to peace."

The final remark was an aside. Gosseyn looked quickly at some of the other men, but their faces were intent. If they saw anything odd in the description of Enro as a man of peace they held their counsel.

He had several thoughts of his own. So an involved spy system had procured for Enro the Distorter patterns of thousands of league bases. It seemed to Gosseyn that there was a fateful combination of forces now working in Enro's favor. In the period of a few short years he had risen from the hereditary rulership of a small planetary group to the height of galactic power. And as if to prove that destiny itself was on his side, during that

same period a planet of Predictors had been discovered, and those gifted minds were now working for him.

True, the Follower who supplied them had plans of his own. But that would not stop the war.

". . . Of course," Grand Admiral Paleol was saying, "the main league centers in this area are not rubbing out their Distorter patterns. It takes time to build up similarity connections, and their own ships would be cut off from any bases in which the patterns were altered. However, in future we must reckon with the possibility that more and more groups will try to break away into isolation. And some of them will succeed.

"You see"—his long face creased into a cold smile "there are systems which cannot be approached by similarizing to bases beyond them. In planning our campaign we made a point of launching all our initial attacks against planets that could so be approached. Now, gradually, our position will become more flexible. We must improvise. Fleets will find themselves in a position to attack objectives that were not formerly considered to be within our reach. To know when such opportunities exist will require the highest degree of alertness on the part of officers and crew members of all ranks."

Unsmiling now, the old man looked around the table. "Gentlemen, that about concludes my report. I must tell you that our casualties are heavy. We are losing ships at the average rate of two battleships, eleven cruisers, seventy-four destroyers and sixty-two miscellaneous craft every hour of operations. Of course, these are actuarial figures, and vary greatly from day to day. But nevertheless they are very real, as you can see by glancing at the wall estimators in this room.

"But basically our position is excellent. Our great obstacle is the vastness of space and the fact that it takes the time of a portion of our fleet to handle each separate conquest. However, it is now possible to estimate mathematically the length of the campaign. So many more planets to conquer, so much time for each—altogether ninety-four sidereal days. Any questions?"

There was silence. Then at the far end of the table, an admiral climbed to his feet.

"Sir," he said, "I wonder if we could have the views of the Prince Ashargin."

The grand admiral arose slowly. The smile was back on his long, usually dour face. "The prince," he said dryly, "is with us as a personal emissary of Enro. He has asked me to say that he has no comments to make at this time."

Gosseyn climbed to his feet. His purpose was to have Ashargin sent back to Gorgzid, to Enro's headquarters, and it seemed to him the best way to do that was to start talking out of turn.

"That," he said, "is what I said to the grand admiral yesterday."

He paused to wince at the high tenor of Ashargin's voice, and to relax the tenseness that swept Ashargin's body. In doing so he glanced at the old man beside him. The grand admiral was gazing up at the ceiling, but with such an expression that Gosseyn had an insight into the truth. He said quickly:

"I am momentarily expecting a call from Enro to return to make my report, but if I have time I should like to discuss some of the philosophical implications of the war we are waging."

He got no further. The ceiling grew bright, and the face that took form on it was the face of Enro. Every man in the room sprang to his feet, and stood at attention.

The red-haired dictator stared down at them, a faint, ironic smile on his face. "Gentlemen," he said at last, "because of previous business, I have just now tuned into this council meeting. I am sorry to have interrupted it, particularly sorry because I see that I came on the scene just as the Prince Ashargin was about to speak to you. The prince and I are in accord on all major aspects of the conduct of the war, but right now I desire him to return to Gorgzid. Gentlemen, you have my respects."

"Your excellency," said Grand Admiral Paleol, "we salute you."

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He turned to Gosseyn-Ashargin. "Prince," he said, "I shall be happy to accompany you to the transport section."

Gosseyn said: "Before I leave I wish to send a message to Y-381907."

Gosseyn planned his message in the belief that he would shortly be back in his own body. He wrote:

SHOW EVERY COURTESY TO THE TWO PRISONERS YOU HAVE ABOARD YOUR SHIP. THEY ARE NOT TO BE TIED OR HANDCUFFED OR CONFINED. BRING THE PREDICTOR WOMAN AND THE MAN, WHETHER HE IS UNCONSCIOUS OR CONSCIOUS, TO GORGZID.

He slipped the message sheet into the slot of the roboperator. "Send that immediately to Captain Free on Y-381907. I'll wait here for an acknowledgment."

He turned and saw that Grand Admiral Paleol was watching him curiously. The old man smiled, and said with a tolerant sneer: "Prince, you're something of an enigma. Am I right in believing you think Enro and myself will some day be called to account for what we are doing?"

Gosseyn-Ashargin shook his head. "It could happen," he said. "You might overreach yourself. But actually it wouldn't be a bringing to account. It would be vengeance, and immediately there would be a new power group as venal, though perhaps more cautious for a while, as the old. The childish individuals who think in terms of overthrowing a power group have failed to analyze the character that binds such a group. One of the first steps is the inculcation of the belief that they are all prepared to die at any moment. So long as the group holds together no individual member of it dares to hold a contrary opinion on that basic point. Having convinced themselves that they are unafraid, they can then justify all crimes against others. It's extremely simple and emotional and childlike on the most destructive level."

The admiral's sneer was broader. "Well, well," he said, "quite a philosopher, aren't you?" His keen eyes grew curious. "Very interesting though. I had never thought of the bravery factor being so fundamental."

He seemed about to speak again, but the roboperator interrupted. "I am unable to get through to the destroyer Y-381907."

Gosseyn-Ashargin hesitated. He was startled. He said: "No contact at all?"

"None."

He was recovering now. "Very well, keep trying until the message is delivered, and advise me on Gorgzid."

He turned, and shook hands with Paleol. A few minutes after that he pulled the lever of the "Distorter" cage which was supposed to take Ashargin back to Enro's palace.

TO BE CONTINUED

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(*Continued from page 6*)

cies involved, they'd never get there.) And worst of all, the physicists find that several bits of the equipment contain radioactive material. They know about radium, uranium, thorium, et cetera. But—this is highly radioactive, and it's *cobalt*. But cobalt isn't radioactive! But this is, and it is cobalt. (It's the transmit-receive tube; the radiocobalt is used to keep it ready to ionize easily and instantly.) They also find radioactive emanations from much of the plane's material, with faint indications that half the elements in the chemical table are radioactive—which is arrant nonsense! (The guided missile had been flown through the fringes of an atomic bomb test gathering report data.)

In summary, the aerodynamicists report that the tailless monstrosity is interesting, but the principles of its design are confusing. The engine group report the "engine," so-called, can't be the engine. It was thought for a while that it might be a rocket, but since both ends are, and always were, wide open, it can't possibly be a rocket. The radio experts of the Signal Corps agree that some of the equipment is an immeasurably advanced type of radio apparatus, but the design is so advanced that it is futile to study it. It can't be reproduced, and involves principles evidently several centuries ahead of the knowledge of 1920—so advanced that the missing, intermediate steps are too many to be bridged. The mystery electronic equipment, called Equipment Group X, remains simply mysterious, save that, in some way, it involves a receiver operating on an unknown, but very high frequency. (By which they meant not the ten thousand megacycle input but the "low" frequency intermediate frequency amplifier, operating at only thirty megacycles. Having no means of generating thirty megacycles at that time, they could only say it was higher than the highest available. And they didn't, of course, recognize the ten kilomegacycle RF head as a receiver at all.)

The physicists would be inclined to ascribe it to Mars, Venus or any other non-terrestrial planet, if it weren't for the obvious Signal Corps markings. Since terrestrial cobalt isn't radioactive, and the cobalt in this ship is—

But anyway, the reports can only be tucked in the "File And Forget" division. About the only thing they can lift out of that piece of marvelous equipment is the secret of making good, small, high-resistance electronic resistors. The chemists and physicists did crack that one, and it's the answer to an electronicist's prayers; the tiny resistors are not wound with sub-microscopic resistance wire, as was at first believed—they're little ceramic tubes filled with a composition of clay and

graphite which is such an extremely bad conductor that it does the job beautifully. By varying the composition, resistors of a standard size can range from one ohm to one hundred million.

At that, our 1920 group was really lucky. Suppose the item that fell through a time-fault had carried an atomic warhead. If it didn't go off, it would have presented the physicists with two of the most dangerous, utterly inexplicable lumps of matter imaginable. Pure U-235 or pure plutonium—that would have driven the chemists mad!—before they'd even discovered synthetic radioactivity. They would have been certain to kill themselves by bringing those two masses too close to each other, though, out of the bomb mechanism, they wouldn't have exploded.

But—write your own ticket, in your own special field. Let 1920, or 1910, or 1890 try to understand the functioning of any one of your modern gadgets. Even though, in those years, first-rate scientists with a full understanding of scientific methodology, and with fairly complete laboratory equipments, were available!

THE EDITOR.

Statement of the Ownership, Management, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Astounding Science Fiction published monthly, at New York, N. Y., for October 1, 1948.

State of New York, County of New York (*ss.*)

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared H. W. Ralston, who, having been duly sworn according to law, deposes and says that he is Vice President of Street & Smith Publications, Inc., publishers of Astounding Science Fiction, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

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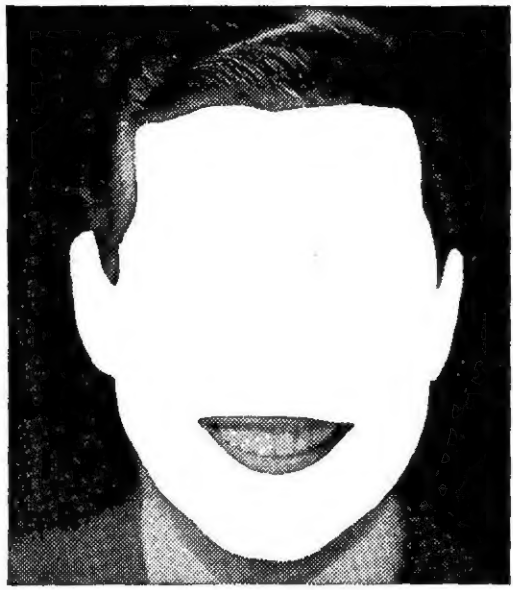

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